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ABSTRACT

This publication seeks to provide Iowa teachers, school administrators, and others with a framework and perspective on developing programs in environmental education. The basic principles of environmental education are presented as a foundation for school programs. Strategies are identified to illustrate a framework within which existing school programs can be modified to incorporate environmental education. Learning activities included are provided as examples to guide teachers in developing their own activities. A segment is devoted to Iowa's environmental education legislation and its impact on curricula. Other specific topics include curriculum sequence, outdoor laboratories, using community resources, simulation gaming, case studies, and land use planning. A list of teaching resources and references is provided. (Author/RE)

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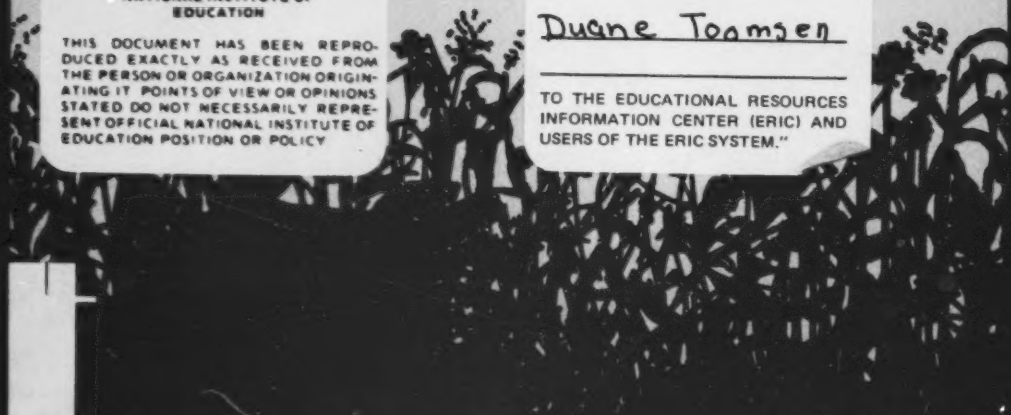

Environmental Education Process for Iowa Schools

by

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Foreword

This publication is designed to provide Iowa teachers, school administrators and others with a framework and perspective on developing programs in environmental education. It is particularly timely since federal law, state policy and concern over local control are placing a strong emphasis on public participation in environmental decision-making. Through Chapter 257.25 of the Code of Iowa, the General Assembly has placed a responsibility upon the schools to prepare students to become environmentally well informed citizens capable of participating fully and intelligently in making environmental decisions. The environmental education process is a modified approach for school programs as they seek to provide students with the fundamentals necessary to function as participants in modern society.

Going into the 1970's, the schools of Iowa generally were not well prepared to assume the legislated responsibility, even though some teachers and some school districts had developed excellent programs. McRae* found in her 1976 survey of Iowa school personnel that 68 percent of the teachers and administrators had never taken a course related to conservation education, environmental education or the environment. Secondary science teachers were the best prepared group with 73 percent having at least one course. The McRae study further showed that the meaning and scope of environmental education needed to be clarified to achieve a better understanding of the school's responsibility as assigned by law.

The relatively brief chapters in this book provide clarification through definitions, descriptions and examples. The basic principles of environmental education are presented as a foundation for school programs. Strategies are presented to illustrate a framework within which existing school programs can be modified to incorporate environmental education. The learning activities are examples of different approaches to guide teachers in developing their own activities. Those wishing more detailed refinement of specific aspects of environmental education as a process or as a subject-field are referred to the voluminous professional literature which is developing.

Teachers and administrators are encouraged to participate in workshops and university courses which include experiences in the environment, natural resources management and environmental decision-making. The authors believe that the most meaningful environmental education programs are those developed by informed and interested personnel for their own schools.

The authors are grateful to those who have contributed to the preparation of this publication. The participants in the Iowa Teachers Conservation Camp program have inspired us in our concern for environmental education. The manuscript was read at least in part by the following who made thoughtful contributions and corrections: Fred Dorheim and Jean Cutler Prior of the Iowa

*McRae, Debra. *Iowa Environmental Education Needs Assessment.* Master of Arts thesis in Biology, University of Northern Iowa, Cedar Falls, 1978.

Geological Survey; Dr. Ross Iverson of the Marshalltown Community School District and Duane Toomsen, Environmental Education Consultant of the Iowa Department of Public Instruction. The following members of the Environmental Education Advisory Council also reviewed the manuscript and made many helpful comments: Susan Baldwin, Carolyn Benne, William Edgar, Charles Miller, Donald Menken, Robert Rye and Kenneth Tow. A special note of gratitude goes to our families whose moral support was an invaluable necessity.

Special thanks also goes to those who contributed photographs and illustrations, without which this publication would not be complete: Lynn Betts, U.S. Soil Conservation Service; Iowa Conservation Commission; Dave Fagle, Marshalltown Community Schools; Sue Baldwin, Burlington Community Schools; Joy Miller, Monticello Community School District; Des Moines Center of Science and Industry; and Ray Benter, Iowa Department of Public Instruction.

1 Environmental Education: A New Process for Teaching Fundamentals

Environmental education is a process by which standard subject matter and fundamentals are given new significance. It is compatible with the existing curriculum and is not a new block of material to be squeezed into a crowded school program. It leads students into learning and using fundamentals to make intelligent decisions which affect their environment. An environmental education program brings exciting new relevance to the fundamentals of communications, mathematics, science, social studies and human relations as they are taught in the context of the environment in which the student lives, works and plays.

The scope of environmental education is outlined in the official Iowa definition adopted by the Environmental Education Advisory Council of the Iowa Department of Public Instruction pursuant to House Joint Resolution 34 of 1975: "Environmental Education means the lifelong education process dealing with people's relationship with each other and with their natural and altered surroundings and includes the relation of population, pollution, resource allocation and depletion, conservation, transportation, technology and planning to the total human environment."

The National Environmental Policy Act of 1969* states, ". . . that it is the continuing policy . . . to create and maintain conditions under which men and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations. . . ." Environmental education programs reflect this concern through use of concepts and approaches from sociology, economics, business management, political science, the sciences the humanities and fine arts, as well as from nature study, conservation education and outdoor education.

The environmental education process recognizes the importance of understanding nature and natural resources in the context of man's attempt to cope with a changing environment. The process brings into focus the interactions of the economic, political, biological, and physical systems which produce environmental change. Clarification of value systems involved in the making of decisions is a highly significant aspect of studying these interactions. Understanding the individual's role in these interactions is essential to enable citizens to influence the decisions which will be necessary to ensure maintenance of a quality environment suitable for their survival.

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*P.L. 91-190, Section 101a

NEA Resolution on Environmental Education

The National Education Association's (NEA's) Representative Assembly passed resolution A-4, Environmental Education, in 1973, reaffirming it in 1974, 1975 and 1976.

"The National Education Association believes the nation's priorities must include the protection of our environment. It urges the development and improvement of federal legislation, programs, and appropriations that provide education: (a) for use, stewardship, and preservation of a viable environment; (b) to eliminate pollution; (c) to promote an understanding by students and the public of the effects of past, present, and future population growth patterns on world civilization and human survival; and (d) to promote establishment of federal Wilderness Areas.

"The Association urges its affiliates to support environmental programs in school systems for grades K through adult.

"The Association encourages local affiliates to establish procedures to assure that policies and practices adopted by governing boards are consistent with environmental concerns."

The environmental education process is a logical development from nature study, conservation education and outdoor education. While the three parent fields have made, and will continue to make, significant contributions in their own right, environmental education is a more basic approach using fundamentals common to the other three.

Nature study involves learning the various components that comprise the natural environment with an emphasis on awareness, appreciation and a concern for those components. Conservation education includes the status and distribution of natural resources used by man, techniques of resources management and the development of public policy regarding natural resource allocation. Outdoor education is a group of instructional methods with a strong emphasis on recreational use of the out-of-doors. The methods of outdoor education have long been used in nature study and conservation education and are easily adapted into the environmental education process where appropriate. Problem solving, reading, research, indoor and outdoor laboratory experiences, lecture and discussion, role-playing and simulation gaming, and audio-visual techniques are some of the other methods particularly well suited for the environmental education process.

Goals of Environmental Education

1. To develop an awareness of the components of the physical, biological and cultural environment and how the pieces fit together.

2. To develop an appreciation of the needs of society for natural resources and limitations of those resources.

3. To develop a working knowledge of the fundamentals of the sciences and their application to natural resource management and consumption.

4. To clarify value systems regarding man's responsibility to his present and future environment.

5. To develop an understanding of the political and economic interactions involved in deciding between alternatives.

2 Recognizing the Iowa Environmental Problem

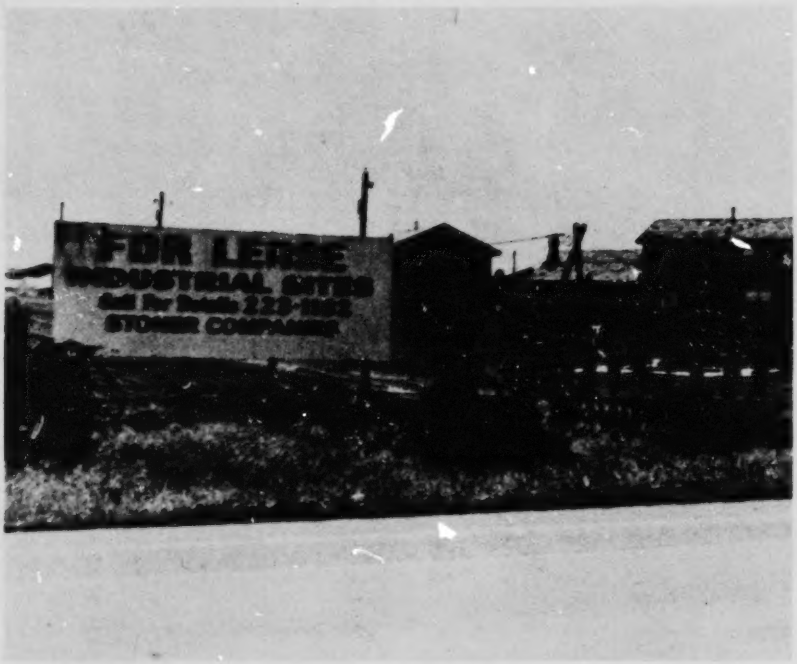
The history of Iowa has been, and will continue to be closely linked to the use of natural resources from the environment. Some examples of environmental situations that have determined the distribution of people and financial resources in the state are: topographic considerations for the location of highways and railroads; environmental similarities to the home country for immigrants; the availability of coal, limestone or gypsum; the differing ease of converting prairie, woodland or marsh to farmland; the agricultural capability of various soils; and the existence of rivers.

The population has grown, creating heavier demands for resources, including space in which to work, live and play. Iowa's climate, high quality soils, capable farmers, well developed industry and agri-businesses have made the

state an area upon which the people of the nation and the world depend. Today, Iowa's environment is showing the strain of meeting these increasing pressures.

Fortunately society is changing to provide the means of minimizing some of these problems. Although major changes tend to occur slowly, they result from an accumulation of many small changes. These small changes are taking place daily in different areas of society. Science and technology are providing more techniques for environmental quality control, and are becoming more sensitive to environmental concerns. Political systems are being formed through governmental agencies and citizen participation to make decisions on resource use and maintenance of an environment which is capable of supporting society. The economic system is adjusting to reflect environmental costs of production which were ignored when their impacts were less. The educational system is being redirected to assist present and future citizens in understanding the processes underlying environmental change as well as the processes by which society is changing.

Iowans, along with people throughout the world, are becoming more aware of their environmental impact. They are realizing the necessity to accept their responsibilities toward the only environment they will ever have. Learning to live in an environment that has a limited capacity to produce goods and services is not easy. Competition for the use of limited environmental resources is becoming increasingly severe.

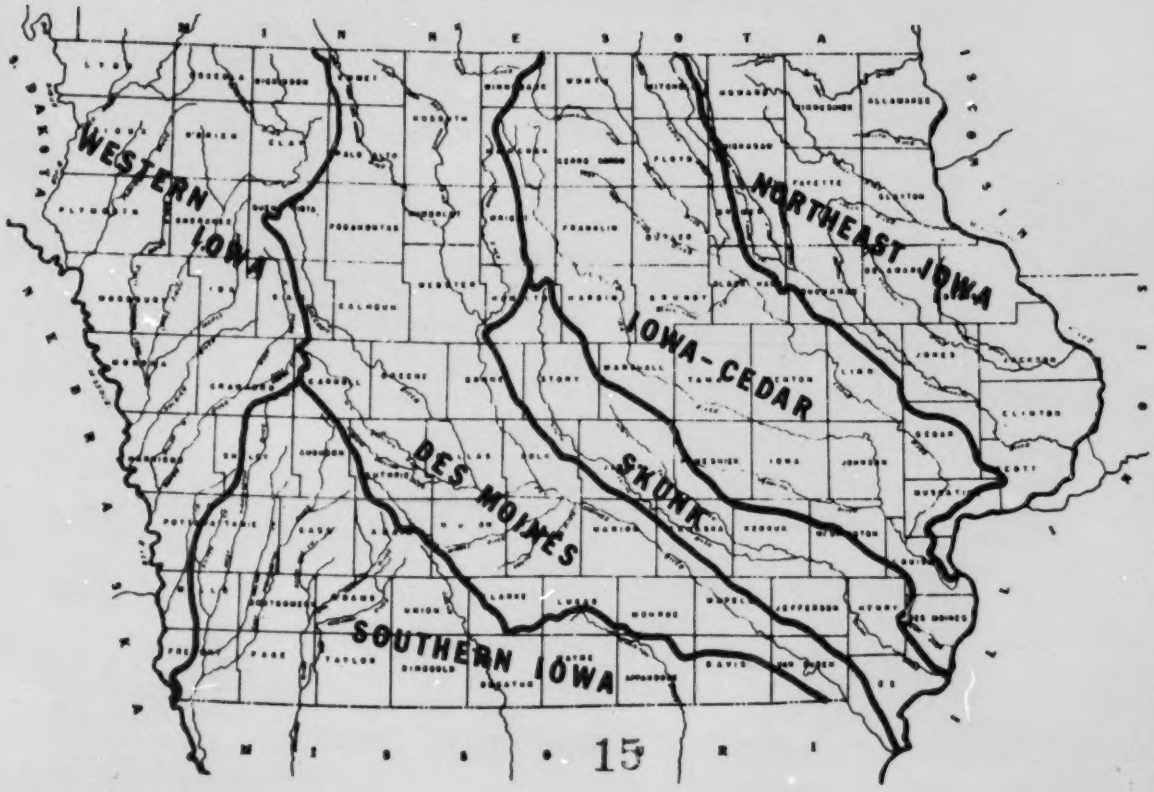


Competition for land in Iowa has become acute among agriculture, housing, transportation, recreation, flood plains and wildlife. Critical land areas are being identified as requiring special management and protection. More and larger cars and trucks are requiring more land devoted to highways. Better roads and more leisure time are contributing to increased demands for recreational areas. Relatively undisturbed natural areas are disappearing so rapidly that steps are being taken to preserve some examples of Iowa's environmental heritage for vital scientific research and for educational and historic purposes.

The decisions of today on how the resources and the environment are to be used will have significant effects on the future of our society. Federal, state and local legislation and rules have already been adopted in various areas of environmental concern. The future consequences of today's decisions are so critical that federal law now requires that the public have an opportunity to help in decision-making. New governmental approaches are being developed to provide maximum local public participation in setting environmental priorities and making environmental decisions.

In many areas, local and regional planning, along with the governmental tool of zoning, provide the public with an opportunity to participate in determining its own future environment, as conflicts over land use are resolved. County land preservation committees have been established by state law to present local public interests in the development of a state land use policy.

Conservancy Districts



Conservancy districts have been formed along river basin lines to seek public input in the formation of a comprehensive approach to soil and water problems. Pollution control regulations, designed to protect the health and welfare of people, have been reviewed by the public before final adoption.

An energy dependent technology has provided the tools for increasing productivity in all phases of human activity. However, its impact on the environment has increased at the same time, bringing a faster rate of environmental change. Larger and more efficient farm equipment, fertilizers and crop genetics have meant larger farms with larger fields producing a greater yield of crops per acre.

Along with increased production of food, feed and livestock from larger farms has come a decline in farm population and socio-economic problems for some parts of Iowa. Soil erosion from wind and water has increased severely causing land deterioration and destruction. Soil and the chemicals attached to soil particles have become major pollutants of Iowa streams. Wildlife food and cover have been substantially reduced.

Competition for the limited supply of world fossil fuel resources is currently causing us to reexamine our heavy use of energy. As utility bills rise, energy conservation measures become more popular. Development of alternative energy sources for Iowa is being pursued with great seriousness.

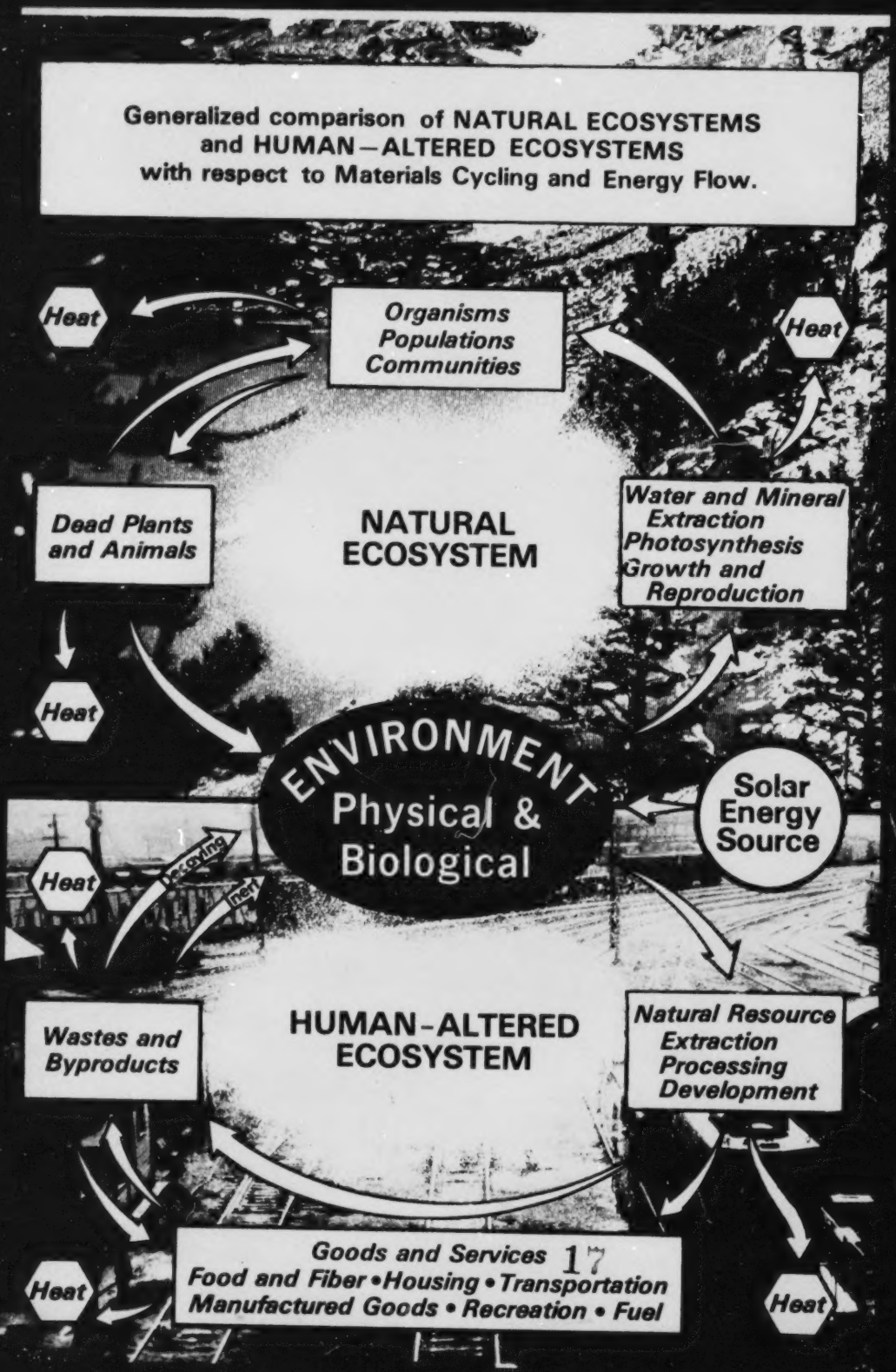
Improvements in industrial production and agricultural chemicals have resulted in a greater quantity of more sophisticated wastes being added to Iowa's air, land and water. These wastes have on occasion overloaded the capacity of the environment to deal with them safely. Air pollution and fish kills have come to Iowa.

Forced into energy conservation programs and pollution controls, many industries and businesses are finding profits in such measures. Reduction in waste production and reclamation of raw materials from wastes inside the plant have become worth the effort. Heat recycling within a plant cuts fuel bills. Farmers can obtain free sewage sludge and reduce fertilizer purchases. Recycling of aluminum cans yields large energy savings to aluminum manufacturers. Old newspapers find new use in home insulation and wallboard. Some problems remain with the universal application of new technologies such as these, but continued progress toward using wastes as raw materials can be expected.

The natural ecosystem and the human altered ecosystem are essentially the same with respect to the flow of energy through them and the cycling of materials within them. A generalized comparison of these two ecosystems is shown by the diagram in this chapter.

The sun is the basic energy source for both systems. The human altered ecosystem makes use of solar energy stored in fossil fuels in addition to the solar energy used in food production. Heat is the ultimate energy product of the various energy conversions into food and work. Materials come from the environment and are processed with the use of energy for various functions in both ecosystems. In the natural ecosystem, materials eventually return to the environment for recycling, but in the human altered ecosystem some of the materials are returned in a form which is not reusable by either system.

Many interrelationships provide the high level of organization necessary to maintain energy flow and to process materials in both ecosystems. Each interrelationship is equally important in supporting the organization. The human


Generalized comparison of NATURAL ECOSYSTEMS
and HUMAN–ALTERED ECOSYSTEMS
with respect to Materials Cycling and Energy Flow.
Heat
Organisms
Populations
Communities
Heat
Dead Plants
and Animals
NATURAL
ECOSYSTEM
Water and Mineral
Extraction
Photosynthesis
Growth and
Reproduction
Heat
ENVIRONMENT
Physical &
Biological
Solar
Energy
Source
Heat
Recycling
Input
Wastes and
Byproducts
HUMAN-ALTERED
ECOSYSTEM
Natural Resource
Extraction
Processing
Development
Goods and Services
Food and Fiber • Housing • Transportation
Manufactured Goods • Recreation • Fuel
Heat
Heat

altered ecosystem has developed a complex cultural organization to transform energy and materials into goods and services. Whenever the human organization fails to recognize the equal importance of the various interrelationships of the entire ecosystem, there are serious problems. For example, serious air pollution problems develop when harmful chemicals form in the atmosphere from waste materials of gasoline engines and industrial processes. A second example is severe aggravation of erosion and flood control problems by indiscriminate harvesting of trees. Environmental management is devoted to finding ways in which some interrelationships can be altered without destroying the organizational structure of the ecosystem upon which we depend for survival.

Many Iowans are trying to use the environment to produce goods and services without destroying its quality. It is also true that many Iowans are not applying the technology which is available to reduce environmental problems. Some people do not recognize the impact of their actions, some don't care, some lack the money for needed capital investment, some believe that their consumptive alteration of the environment is in the best interest of society, and some have other, real or imagined, reasons.

The educational system is responsible for providing future citizens with the skills and basic information needed to cope with a changing environment and a diminishing resource base. The future of our environment and our society will be determined by how well people, individually and collectively, use the environment safely within its capabilities. People must learn to anticipate their impact on others and on the future. People must learn to use natural laws and economic and political systems in cooperation with the environment. We can no longer tolerate the attitude that people are in conflict with their environment.

3 Strategies for Implementing Environmental Education Programs

The first steps in implementing an environmental education program are identifying general objectives and organizing a curricular sequence. The objectives and the sequence presented in this chapter have proved successful in bringing a focus to efforts to implement environmental education programs in Iowa. Although both the objectives and the sequence presentations are arranged from simple to complex, no attempt has been made to assign them to grade levels or subject areas. It is the responsibility of the faculty and administration of each school district to analyze their own situation and incorporate the objectives into the curriculum where they can best be accomplished to achieve environmental literacy and competence.

Curriculum Sequence

An environmental education program is composed of three phases: 1) environmental awareness, 2) natural resource use and environmental management, and 3) environmental decision-making.

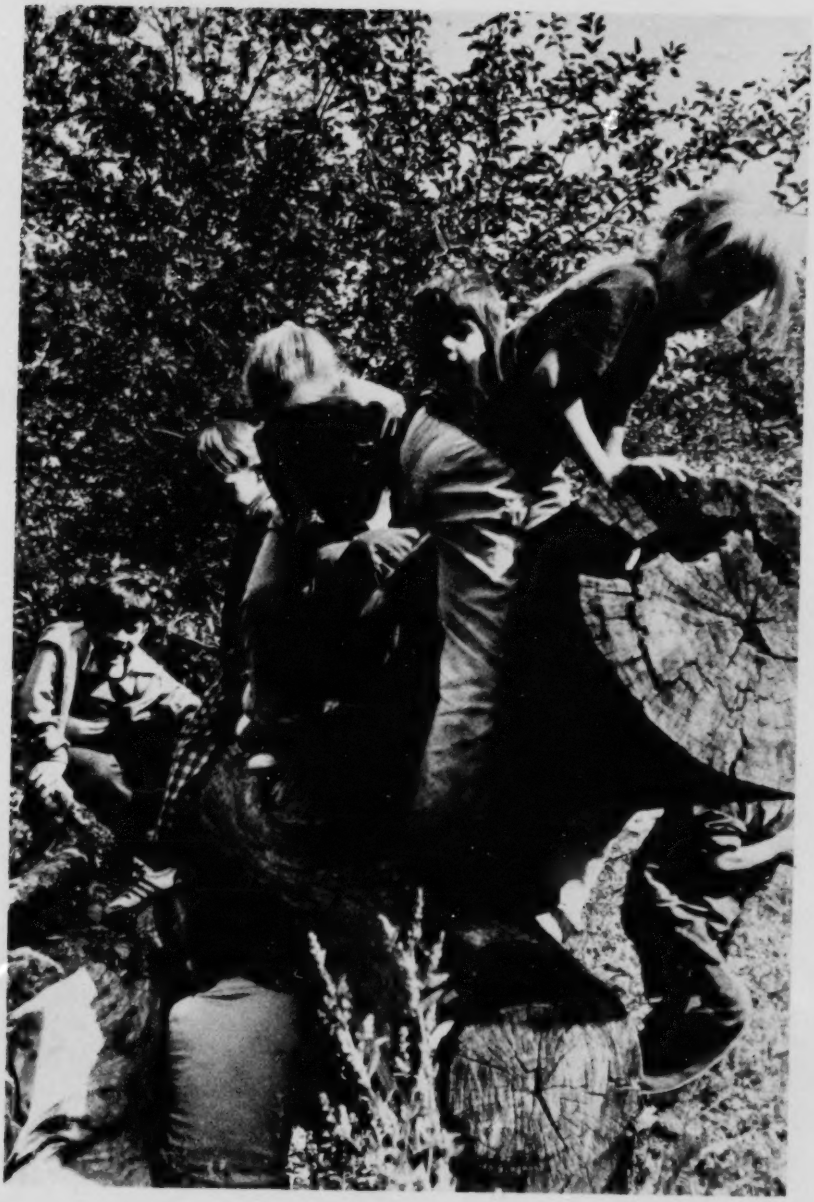
Awareness Phase

The awareness phase provides experiences with the natural and man-made environment. The identification of individual roles in both society and nature are included in this phase and lead to the understanding that all people and all things have important contributions to make to the world around us. The awareness phase is concerned with what is in the environment, what necessary functions need to be performed, and how the pieces fit together into a functioning whole. Local natural resources can be identified and their uses explained. The need for variety in the environment---to perform various functions and to provide a satisfying environment for people---is stressed. A concern for the impact of the individual's actions on other people and on the natural environment is promoted through the development of attitudes of caring, sharing, accepting responsibility and respecting the worth and rights of people, plants and animals.

Included in the awareness phase is the clarification of values. Students explore reasons for their likes and dislikes as well as what they think is right or wrong with their environment.

The awareness phase can begin in preschool and kindergarten. be emphasized in lower elementary, and extended through subsequent years.

Early in life the individual begins exploring the immediate environment. The dimensions of the environment expand as more experiences are gained. It is in the preschool and lower elementary years that a basic familiarity with the components of the child's environment can be developed. Upon this basic familiarity is based the expanding awareness and understanding of later years.



Generalized Objectives of an Environmental Education Program

1. The student will develop an awareness, an appreciation and a concern for his/her immediate environment.

2. The student will learn about the various components that comprise the natural and man-made environment.

3. The student will gain knowledge about the basic environmental concepts that affect life including the conservation of natural resources.

4. The student will be able to think critically and make value judgments about man's impact on the environment and the societal and environmental changes resulting from natural resource use.

5. The student will understand the public policy decision-making process and be able to make inputs into current environmental decisions.

Natural Resource Use and Environmental Management Phase

Building upon the awareness phase, the resource use phase explores the condition of the natural resource base. The existence and availability of resource reserves are covered, as well as the quality of those reserves. Renewable and nonrenewable resources are identified, and resource recovery after use is introduced as a means of reducing demand for virgin resources.

Patterns of resource consumption and use are explored, beginning with the student's own personal patterns. This is followed by consideration of those resources used on the student's behalf to produce and transport goods that are directly consumed. The concept of the natural resource base is extended worldwide to include world supplies and the international implications of foreign relations.

Differences in capabilities of resources and environments to produce goods and services are emphasized. Not all water is fit to drink. Not all soils have the same productivity or ability to support buildings. Not all people are the same. Not all forests are the same. Wildlife species are limited in their distribution by the capacity of the environment to support them.

The problems encountered in production from natural resources are illustrated, as well as the problems caused by making use of various resources. Cause and effect relationships are stressed showing both desirable and undesirable effects.

The technologies used to lessen undesirable effects provide excellent examples for the application of science principles. The degree to which technology has been used, and identification of who is responsibile for its use, provide opportunities to apply principles of social science. Exploring attitudes toward accepting responsibility and recognizing environmental limitations provide opportunities for continued clarification of value systems.

Various careers can be investigated in connection with managing, extracting and transporting resources and changing them into finished goods and services.

The natural resource use and environmental management phase is a natural outgrowth of the awareness phase. The lower elementary level begins the phase focusing on the student's personal use of things and developing a conservation or wise use ethic. Upper elementary, middle school and junior high levels emphasize the applications of science and social science to resource use and environmental management. Junior high social science coordinates with science to deal with how the community is proceeding with the management of its environment. Literature, art and music contain many examples of environmental interpretation which can be studied.

Environmental Decision-Making Phase

The middle school and junior high school levels can begin the exploration of decision-making as they deal with environmental management. As more advanced knowledge is presented throughout high school, the applications of that knowledge and its implications for environmental and societal concerns are explored. At the high school level, students should be sufficiently educated to be ready for experiences in the processes by which environmental decisions are made in a democratic society.

The understandings and skills of all instructional areas are used in focusing on student-centered, problem-oriented experiences. The problems may be personal, local or wider in scope. The study involves the student in current and relevant application of the integrated process of environmental decision-making.

Various courses in such areas as home economics, industrial arts, science, social science and literature provide easy opportunities for extension into environmental decision-making, the clarification of values and attitudes toward the environment, and the understanding of interactions.

Secondary students who have sufficient maturity and intellectual sophistication with interrelationships can become involved in making societal environmental decisions. Such involvement will provide direct experiences with the process and the systems which operate within the process. Through such practice, the students will learn how to become effective citizens in a democratic society.

Outdoor Laboratories and Field Experiences

One of the most significant means of learning about the environment is to learn from the environment. Indoor instruction is important in setting the stage for direct experience and for developing the full meaning of what has been seen and experienced. Furthermore, some topics are not suitable for direct experience. In these cases, indoor teaching is the most effective instruction. It is the learning from the environment, however, that will provide the enthusiasm and impact necessary for retention and values clarification.

The endless variety of objects and situations in the environment provide an excellent opportunity for both teacher and students to learn from the environment together. If the students have been taught some of the

fundamentals, the teacher in the out-of-doors needs only to direct the students with leading questions. The environment will unfold some of its mysteries to the observant and curious student and teacher.

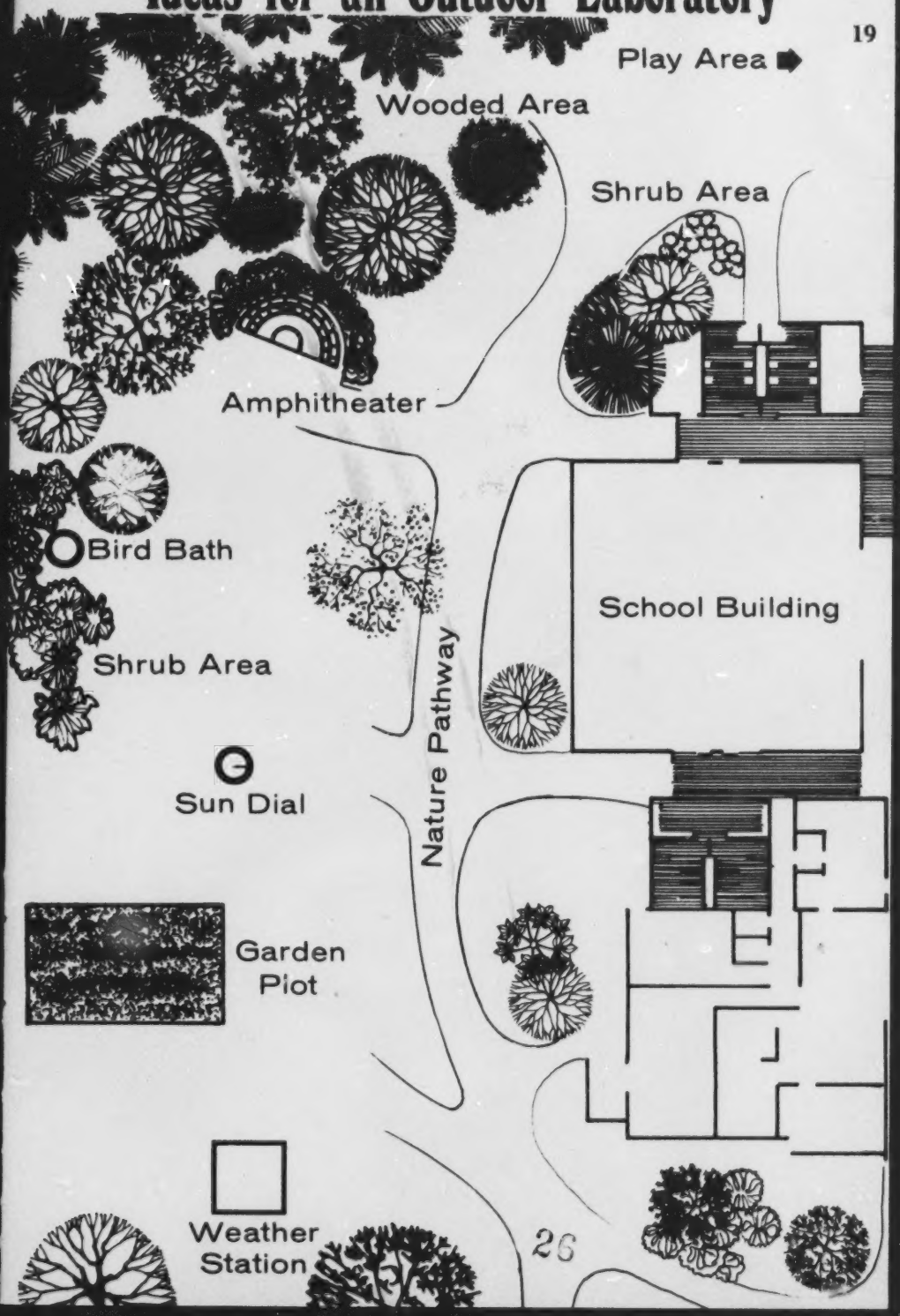
The plot of ground occupied by every school has potential for many brief mini-laboratory experiences to illustrate environmental concepts. Many schools in Iowa have recognized the importance of the outdoor laboratory in effective teaching and are developing even more instructional opportunities on school sites. County Conservation Boards have designated a number of areas as nature centers or environmental education centers and have developed them for use by schools and the general public.

Using Community Resources

Everyone can appreciate and understand those things which are subject to direct personal observation. Many of the complex interactions and interrelationships of the environment become common sense applications of basic concepts when viewed locally on a small scale. The neighborhood in which a person lives, whether it be farm or city, provides the proper locale for beginning studies of the environment. The natural and man-made components and forces which make the neighborhood what it is can be identified and related to each other. Man's desirable and undesirable impacts over time can be evaluated. Environmental problems can be assessed. Environmental management and the roles of the individual in decision-making can be observed and practiced. Since no neighborhood is an isolated entity, students will ultimately need to place the neighborhood into the larger contexts of community, region, state, nation and world.

Each farm, each town and city, each county has a natural resource base and exists in an environment which should be understood by the residents. Where does drinking water come from, how is it processed, how is it delivered to the faucet? Where do the different kinds of wastes go, how are they processed or treated? What kinds of energy are used, where does the energy come from? What

Ideas for an Outdoor Laboratory



happens to the rain that falls and the snow that melts? What are the capabilities of the soil for farming, gardening, lawns and supporting buildings? The list of questions to be asked and answered is endless.

There are many people in any community who can help students understand their local natural resource base and environment. Local, state and federal officials with local offices have much information available. A list of some of these sources is given in Chapter 7. Local businessmen are involved in resource use and development. Within the general public are many people with interests, hobbies and avocations related to the environment. Each school district should have an annotated directory of such community resources.

As a community is studied using the environmental education process, many other educational objectives are being met such as in career education, local government, and applications of science, mathematics and language arts. The basic tools are used to gain an understanding of the environment and of the student's role in that environment.

Simulation Gaming

Simulation gaming is a method of practicing decision-making. The technique is being used increasingly by government leaders, corporate executives and teachers. A hypothetical situation is described which contains problems requiring resolution. Roles are identified and assigned to group members. The group members then interact to resolve the problems. The conclusion of a simulation gaming exercise is the debriefing in which the group reviews and analyzes the interactions which produced the decisions. The debriefing analyzes the completeness of the information given in the description of the situation and identifies questions which should be asked. An example of a simulation game is given in the last activity in Chapter 6.

Simulation gaming may or may not involve role playing. However, persons who assume roles other than those which they normally perform are more apt to be objective and less emotionally committed to a particular solution.

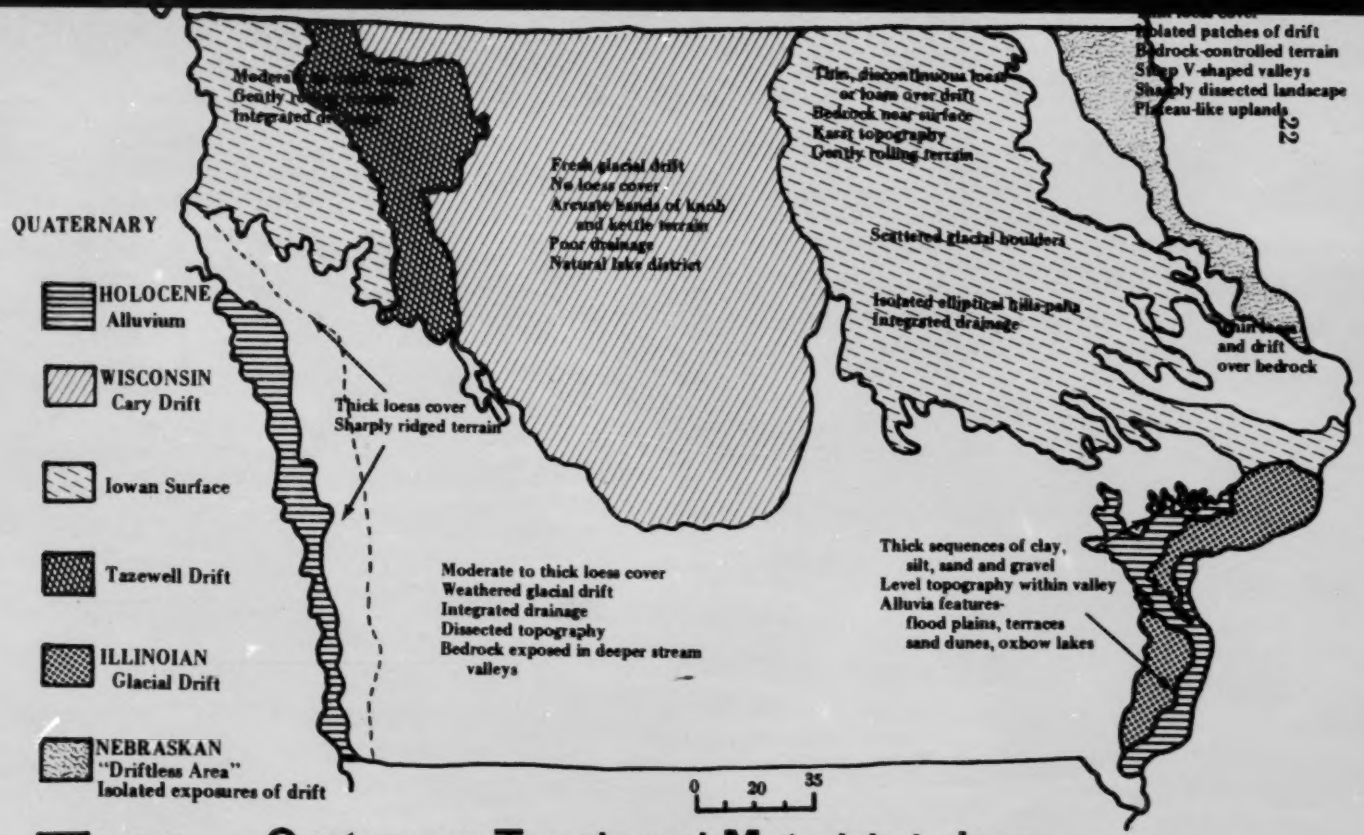
Case Studies

A case study is a report of a situation and an analysis of the outcome. Environmental case studies may be used in several ways. Students may review previously written case studies to learn how others have approached environmental problems. Another method is for the teacher to distribute only the portion of a case study which presents the situation, allow students to produce their own answers and then compare student answers with the actual conclusion and analysis of the case study. A third possibility is to have students prepare their own case study of a current environmental decision-making situation.

4 Focus on Land Use: An Integrative Study

The state of Iowa encompasses 35.8 million acres, much of which is highly productive cropland. Most of this land is easily accessible and poses only minor problems for cropping. Over half the land is classed as level to slightly sloping with minimal susceptability to water erosion. Because of Iowa's glacial history, the counties in the upper-middle one-third of the state are composed of more than 70 percent of this kind of land. About seven percent of Iowa's land is considered suitable for infrequent cultivation only, while another 11 percent in flood plains poses problems for cultivation. Blessed with a favorable climate, Iowa is a leading food producer, not only in the Midwest, but in the entire world.

What has caused the state of Iowa to be so well endowed? What has this land produced in the past and what is its capability for the future? To study what has been, what is and what may yet come requires applying all of man's academic disciplines to the examination. What Iowa and Iowans possess in the land is the result of an interaction of climatic, geologic, and biologic changes and time — a great deal of time.



Quaternary Terrain and Materials in Iowa

from "A Regional Guide to Iowa Landforms" by Jean Prior Iowa Geological Survey Educational Series No. 3

GEOLOGY

If we were to project ourselves a few hundred million years backward in time to a period when the area of North America we now call Iowa was beneath a sea, we could begin a most important examination of our heritage. This shallow sea, with its ability to cycle nutrients from bottom to surface because of currents, wind and tides, was richly alive with large fish-like animals and sea weeds, as well as minute creatures which scientists call corals and plankton. Many of these latter types formed mineral encrustations about their vulnerable bodies and thus were given protection from the environment. As the lives of the plankton progressed, their protective coverings thickened as more minerals from the sea were added to them. When they died, their remains drifted slowly to the sea's bottom, settling among others.

PALEONTOLOGY

Many years were required to build layer upon layer of these lime secretions which came under pressure from the weight of the sea and sedimentary accumulations. This pressure, together with periodic changes in climate, sea level and the sea's living community, produced the limestone which now underlies most of Iowa. Thus, both the geology and biology of that period conspired to produce the geology of our present day.

The second most common bedrock type, sandstone, was produced largely at the sea's margins. Sand washing from the land into the sea was carried by tides to the intertidal areas. The changing margins of the sea produced an interesting pattern of sandstone-limestone accumulation. This, together with powerful geologic forces of mountain building in the West and East, glaciation and water erosion, has molded the physical appearance of Iowa's topography.

The sea departed as climatic changes slowly occurred, leading into a time when Iowa's surface was periodically covered, uncovered and then covered again by great sheets of snow and ice —— the glaciers. The forceful movement of this mass of frozen water further added to the base of Iowa's land. Materials were pushed and carried by the glaciers from the north and later redeposited. Silts, blown from the west by prevailing winds, were also deposited while the glaciers covered the land and during melting phases. The collective effects of marine and glacial environments produced Iowa's unique topographic features and provided the basis upon which further land modification could occur.

Most of Iowa's soil, when first cut by the plows of European immigrants, was supporting a dense growth of grasses and forbes in what later became known as the prairie. Some of the soil, especially in the eastern one-third of the state, was covered by mature hardwood forests. This

difference was due largely to the availability of water from precipitation.

Iowa's eastern boundary receives the minimal rainfall needed to adequately support deciduous forests —— about 35 inches per year. At the western boundary the rainfall averages as little as 25 inches each year. Grasses, especially the tall grasses and forbes, grow exceptionally well in these lower rainfall regions. Some would say that even these lower rainfall quantities would support forestation were it not for the periodic burning of the grasslands. Burning such as this no doubt occurred both as a result of natural causes (i.e. lightning) and the use of fire by Indians, both intentionally and accidentally. ECOLOGY

Years of growth, death and decay of the prairie and forest communities developed deeper and deeper layers of humus. It is in this humus that the unique productivity of Iowa's land rests. Humus, a unique blend of subsoil minerals —— sand and clay —— with the products of decaying organisms, is a bank from which materials may most readily be withdrawn for use by plants in their growth. Here, also, is a bank which receives, stores and releases moisture to the growing plants.

The soil produced under prairies has a deeper, richer humus than that produced under forests. So it is not unreasonable to expect that in the prairie portions of the SOIL SCIENCE

state lie our most productive soils. Were it not for the effects of topography and climate, this statement would go unchallenged.

Productivity is not merely a matter of soil. The richest soil might be in a physical situation which would make it nearly impossible to cultivate. If the soil lacked sufficient water, or was saturated with water, conditions for cultivation would also be bad. Clearly then, productivity is a result of the availability of proper amounts of water at critical times in plant growth, level land and, of course, quality soil.

The events of the past, both geologically and biologically, have produced a natural resource most fundamental to life. The soil provided for deer and buffalo, prairie grasses, maple trees, and people. Today it provides for hogs and cattle, corn and soybeans, and people. European immigrants came to Iowa to subdue the environment and make it work for them. What they found and what they did with it is a story of human ingenuity and endurance.

ECONOMIC GEOLOGY

Minerals Beneath the Surface

We have examined the processes that gave Iowa its physical character and from this, its biologic communities. Early European explorers found that the geologic underpinning of the area was potentially useful. Julian Dubuque extracted lead. Later, coal was dug from hillside croppings, limestone was quarried and gravel was mined from the glacial till. Beneath Iowa's soil is another treasure — mineral resources. These are resources used in powering a technological society and constructing its roads and buildings.

The number one mineral industry in Iowa is the limestone industry. Much crushed limestone has been used as surface material for county roads, making it possible for the farmer to move to and from his fields and take his produce to market. Iowa's county road network is one of the most extensive in the nation.

Seventy-five years ago, dimension limestone was quarried in numerous places in Iowa. But now, Stone City is probably most famous of the remaining three sites due to the art of Grant Wood. State buildings built during the 1930's owe their rugged natural attractiveness to the availability of this building material and the economic depression of the period.

Gypsum is the fourth most important industrial mineral in Iowa. Together with limestone, it is used in the cement industry, the third largest mineral industry. The growth of Fort Dodge from a wilderness outpost to a major community is due largely to the available deposit of

gypsum and its use in the manufacture of cement, plaster and wall board. Gypsum is found in several places other than the Fort Dodge area, and limestone is located throughout the eastern third and north-central portion of Iowa.

Another mineral of great value to Iowa, with yet questionable immediate use, is the one Indians called blackstone. Coal deposits cover much of the southern third of Iowa and extend north as far as Fort Dodge. At one time coal mining was, next to agriculture, the most important industry in Iowa. By the early 1970's, less than 100 people were employed in Iowa's coal industry. At present, the industry ranks sixth in economic importance in the state behind the clay industry.

Each of these minerals, as stated earlier, lies beneath Iowa's soil. In order to obtain and use them, we must either tunnel beneath the soil or remove it. Controversies arise about whether or not productive soil should be disturbed for purposes of mineral extraction. Our society needs minerals and it needs food. Soil scientists say that once the soil is disturbed by mining it, regaining its former productivity is difficult. Thus we are confronted with a major concern for how best to use the land.

Land and Man

SOCIOLOGY

Settlers originally came to this area as part of the westward movement of people, searching to shape their destiny on their own land. The European immigrant from countries such as Germany, Scandinavia, England, Scotland, Ireland, and Czechoslovakia has added a special flavor to the character of Iowa's people. Those first coming to Iowa were primarily interested in farming. Later came those whose support was required in order for farming to be more than merely supporting the family's immediate needs. Mills sprang up along the rivers, roads were built and rails laid.

Iowa became a place for people to experiment with the land and with ways of living on it. Three different groups came to Iowa to establish their own kind of communal living. Of these, only the Amana Colonies remain. Today they are an incorporated capitalistic community. The small contingents of Hungarians at New Buda in Decatur County and French at Icaria in Adams County disappeared in a very short time.

Iowa was also viewed as a place of refuge by such groups as the Amish, Trappists, Mormons and by nationals from various European countries. Most of these came looking for religious freedom at the time when Iowa was being settled. A mark was produced on the land where these people settled which is part of what makes Iowa interesting. The Amana Colonies, Tulip Days in Pella and Orange City, horse and buggies on the highways around Oelwein and Kalona, the Nordic Fest in Decorah, and Kolache Days in Cedar Rapids are a few of the fascinating reminders of Iowa's cultural heritage.

Today, Iowans are less agricultural than ever before. Only about 662,000 people live on and work Iowa's farms. The remainder of Iowa's nearly three million people live in the enlarging cities and towns and gain their livelihood from industries, businesses and professions. This is producing the character of Iowa's city people.

ECONOMICS

What makes Iowa's cities grow? The major immediate answer is people -- people drawn to the jobs produced by the industries in those cities. Iowa produces 23 percent of the nation's pork and 12 percent of its beef. It is, therefore, understandable that the packing industry is big in Iowa cities. In fact, Iowa's industry is largely oriented to the fact that Iowa has a large amount of high quality agricultural land. Cedar Rapids has the largest cereal mill in the world and is the world's largest manufacturer of rock crushing equipment. Waterloo has the largest tractor plant in the world, and Sioux City has the largest popcorn processing plant in the country. At present, the value of agricultural goods produced by Iowa is almost equaled by that from

manufacturing. As Iowans increase in number and their cities increase in size, more land will be required for housing, manufacturing and mining. This same land is also needed to produce food for people in all parts of the world.

Man has moved very rapidly from a close association with the natural environment to almost an isolation from it. This has caused him to lose contact with that which supports his being -- materially and spiritually. That Iowans are aware of this dependence is seen in the establishment of the Iowa State Conservation Commission, the County Conservation Boards and the city park departments. Each of these groups has, as a part of its responsibility, the purchase and maintenance of recreational land for Iowans to enjoy. It is estimated that in the 20 years from 1960 to 1980, Iowans' land needs for natural recreation areas will increase by 176,490 acres. Most of this (97,900) acres) is to be in federal reservoir projects such as Lake Rathbun in south-central Iowa. The second major portion is 45,000 acres in county conservation board recreation areas. Today Americans live on only five percent of the land area, however, each person requires 506 acres of land for food production and five acres of forest for wood and pulp, in addition to land required for mineral extraction and recreation. With facts like these we have good reason to be concerned about the wise use of Iowa's land.

RECREATION

5

Iowa and International Environmental Education

Two dates, April 1, 1971 and October 22, 1975, may prove to be cardinal markers in the environmental education movement. The first is Earth Day I. The second is the closing day of the International Environmental Education Workshop at Belgrade, Yugoslavia. It was at the close of this historical event that The Belgrade Charter was adopted unanimously by the workshop participants.

The Charter provides the framework for worldwide environmental education, based on the premise that environmental education is one of the most critical elements of an all-out attack on the world's environmental crisis. The Charter states that the goal of environmental education is to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones. It continues by pointing to the need for an interdisciplinary approach to environmental education, an education which explores the environment in its totality -- natural and man-made, material and aesthetic.

One of the outcomes of this endeavor is to link all environmentally concerned people around the world. Problems which are common to large areas of the world may be approached from the vantage point of those who have worked on these problems with success. And, efforts that some have found to be futile would not need to be attempted.

From an educational viewpoint, the pedagogies of several nations may be shared. Teachers may have more latitude in selecting successful approaches to teaching environmental concepts and values in their classrooms, based not only on national sources, but on international ones.

In recent years it has become clear that solutions to environmental problems may best be found by improving education at all levels. As a result, people in all walks of life could better understand the fundamental interactions of man and the natural world. The United Nations Education, Scientific and Cultural Organization - United Nations Environmental Program (UNESCO-UNEP) gives strength to the idea that the environment should not be treated as a specific subject as is mathematics, biology or history. Rather, it stresses the need to have environmental education infused into every subject being taught.

A major emphasis is also placed on problem solving so that, when faced with an environmental problem, the student will learn to examine all of the interacting forces which shape the problem as he/she searches for a solution. An objective of this procedure is to reinforce the concept that sound environmental decisions require input from a host of interacting factors: scientific principles, technologic data, values, economics, political and governmental constraints.

Eight major guiding principles for environmental education were developed at the Belgrade workshop. These principles should be carefully examined by anyone teaching or planning to teach from an environmental point of view. The eight principles are:

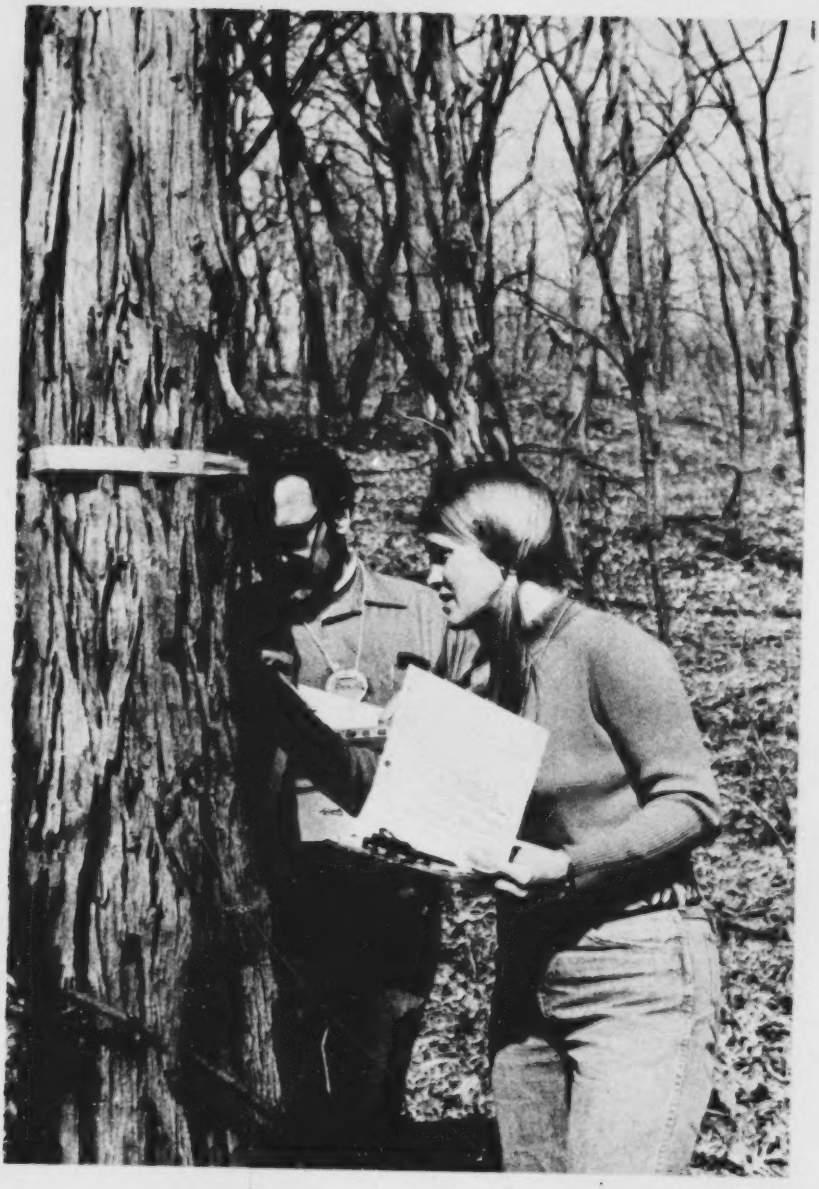
1. Environmental education should consider the environment in its totality -- natural and man-made, ecological, political, economic, technological, social, legislative, cultural and aesthetic.
2. Environmental education should be a continuous lifelong process, both in school and out of school.
3. Environmental education should be interdisciplinary in its approach.
4. Environmental education should emphasize active participation in preventing and solving environmental problems.
5. Environmental education should examine major environmental issues from a global perspective, while paying due regard to regional differences.
6. Environmental education should focus on current and future environmental situations.
7. Environmental education should examine all development and growth from an environmental perspective.
8. Environmental education should promote the value and necessity of local, national and international cooperation in the solution of environmental problems.

Environmental Education in Iowa

With this information about the worldwide concern for environmental education, it is hoped that Iowa teachers will be stimulated to reexamine their own understandings of the environment. Further, it is hoped that Iowa teachers may see means to enhance their teaching so that it is more vital for their students and for themselves.

We who live in Iowa have a strong heritage of harmony between man and soil. The first Europeans to move into Iowa after 1837 were primarily interested in the quality of soil's productivity. The majority were farming people--independent, strong and hard working. Their characteristics may still be seen in the people who work the land. In the one and a half centuries which have passed, Iowa has grown from a principally agricultural state to one which has a mixture of agriculture, mining and industry. Man's mark has been indelibly placed upon Iowa's land.

The population centers of this country have grown into vast megalopolises found undesirable by some who live in them. Today many are migrating from eastern, central and western population centers to rural areas. Iowa is an area being sought by these urban emigrants. What effect will this increased need for living space have upon Iowa where industry, transportation and agriculture are already competing for space? It is clear that the need for environmental education is great in the state of Iowa. It is not merely a question of "how do we save our environment?" It is a larger question of "how do we as a people with many desires, needs and values meet the challenge of the present and look toward a future that is satisfying for all our people?"



6 Learning Activities

The learning activities selected for this publication illustrate a variety of approaches to environmental education. Many are presently used by Iowa teachers. Each is considered successful. Teachers will readily recognize the potentials for adapting activities to a specific grade level or curriculum. The activities have in common a key characteristic of environmental education, an emphasis upon learning **from** the environment rather than merely learning **about** the environment.

There are many books and articles available in professional literature which contain teaching ideas and techniques for environmental education. Many curricula and detailed lists of objectives and concepts are also available. Experience has shown that environmentally literate and concerned teachers will develop their own set of activities and determine their own objectives to fit their local situation. Therefore, the activities presented here are examples to illustrate the goals and objectives given in chapters 1 and 2.

The learning activities in this chapter were selected as being representative of the varied subject matter which may be approached through environmental education. There are activities for use on the school grounds and for inside the classroom. There are activities for different seasons of the year. The arrangement of the activities by level represents the authors' view of the approximate curriculum level at which they can most appropriately be used.

Level I activities are suitable for the beginning awareness phase which commonly is included in pre-school and the primary grades. Level II activities continue awareness and deal with natural resource use and environmental management. They were developed primarily for use in the middle school. Level III activities use more advanced concepts and provide practice in interpretation and decision-making. The creative teacher will be able to adapt most of these activities for use at any particular grade level and to suit the curricular organization of the school system.

Learning Activities for Level I

(Beginning Awareness)

Level I Activity 1

Curriculum Sequence: Environmental Awareness
Goal: To develop an awareness of the components in the physical, biological and cultural environments and of how these pieces fit together.
Generalized Objective: The student will develop an awareness, an appreciation and a concern for his/her immediate environment.

In the following activity, young students assume the roles of plants and animals to learn what functions they perform and how they relate to each other. Students should be assisted in this role-playing exercise to consider how various roles fit together into a whole; e.g., the necessary predator-prey or food chain relationships that exist in nature.

Teachers may wish to develop their own questions to assist young students in thinking about the relationships of their roles to each other and to the whole group.

Become Something in Nature

The students should choose something in nature that they would like to become. (Allow them to pick what they want, plant or animal.) Have each act out what their life would be like if they really were that object in nature.

Discuss with the students what problems they would have and how each would survive in their environment. Ask students if their role would be related to any other roles; e.g., would anyone eat you? Would you eat anyone? Would anyone plant your seeds? etc.

Source: *Elementary Environmental Education Activities – Grades 3-6.* Reproduced with permission from the Marshalltown Community School District.

Level I Activities 2-6

Curriculum Sequence: Environmental Awareness
Goal: To develop an awareness of the components of the physical, biological and cultural environments and of how the pieces fit together.
Generalized Objective: The student will gain knowledge about the basic environmental concepts that affect life including the conservation of natural resources.

The following five activities are concerned with the goal and objective stated above. These activities are structured to take advantage of the natural fascination that young children have for their surrounding environment. The activities are based on the premise that with young children, you start by asking lots of questions and listening intently to the answers. The questions suggested in the activities are structured to encourage children to hypothesize, guess and ask questions. The individual teacher may wish to ask additional questions to accompany those suggested in the activities.

The Trash Basket

Empty the trash basket in the room. What is in it? Can you sort the trash? Are there any papers in it that could be used again? What is paper made from? Why are trees important other than for paper? Why is it important to conserve paper? What does conserve mean? How can we conserve paper here at school, day-care center, or home? What happens to the trash after it leaves here? How can we find out? Does it cost money to have the trash disposed of? Who do you think pays for all this? Why does it cost money? Do not expect answers from all the children, especially the three-year-olds? Just ask questions so that they can start wondering.

Source: Margaret McIntyre, "Some Environmental Observations for Young Children," *Science and Children*, April 1975, p. 24. Reproduced with permission from *Science and Children*, April 1975. Copyright 1975 by the National Science Teachers Association.

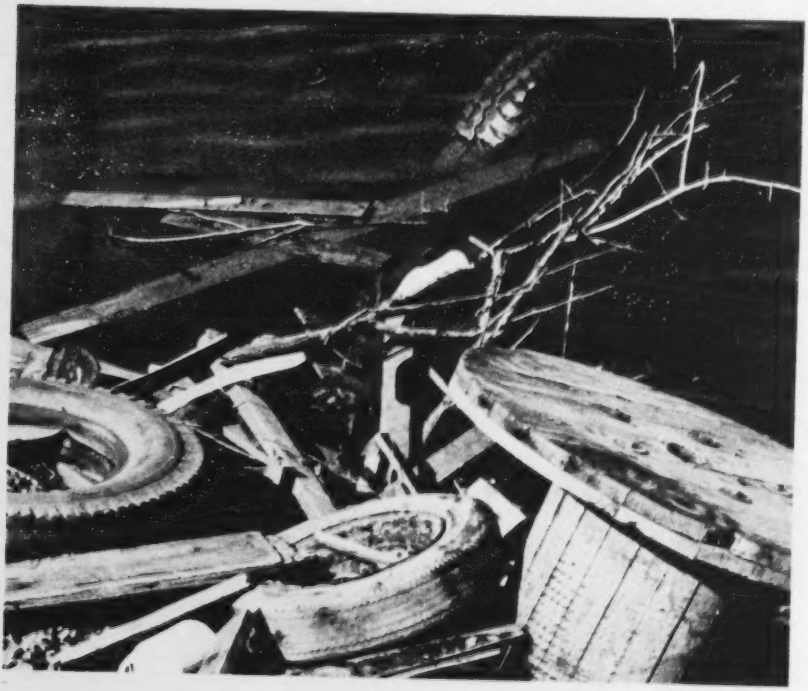
Trash in Other Areas

Visit the school cafeteria or kitchen. What is in the trash basket there? How is it different from trash in the other rooms? Does the trash in the kitchen have an odor? Why? What can we do to make less trash in the cafeteria or kitchen?

Walk to the play area or take a short walk around the block. The children can carry small bags in which to collect trash they see. What kinds of trash do we see? What kinds of trash should children leave for adults to pick up? Why? Empty the trash into big bags. How many do we have? Can we classify it? What do we call people who do not throw trash in proper containers? What can we do to cut down on the amount of trash that we see? Why is it important to pick up trash?

Visit a local store or business establishment to find out what kinds of trash they have. What do they do with it? Do they try to cut down on the trash they accumulate? Are they using materials over and over if possible and recycling? Do you know what recycling means? How can we recycle paper?

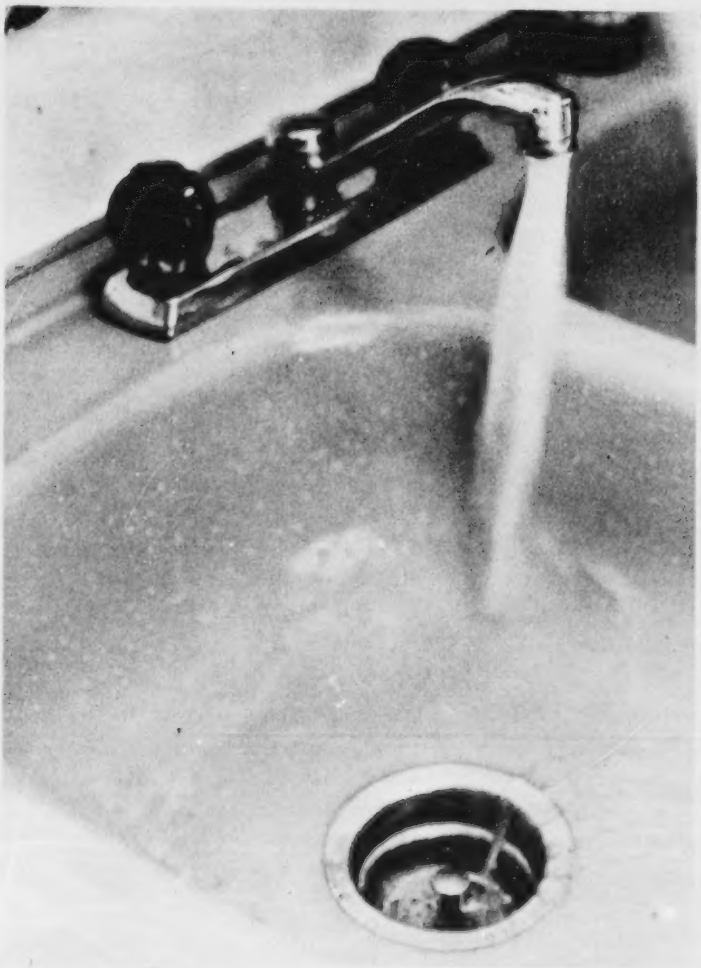
Make a visit to the local gasoline service station. What are the kinds of trash that they have? How is it different from other trash we have seen? What do they do with all the oil drained from cars? Is it reused? How? What do you think they do with old tires?



Source: McIntyre, "Environmental Observations," p. 24. Reproduced with permission.

Water

Turn on the faucet. Where does the water come from? Where does the city, village, or farmhouse get its water? Why do you know it is safe to drink? Is there an abundance of water available around this city or village? How do you know? Class trips may be needed to get answers to some of these questions. Do we drink rainwater? Is it safe to drink? How can we conserve water? Why is this important? Why is water important? What do we use water for in the nursery school or kindergarten? What do you use water for at home?



Source: McIntyre, "Environmental Observations," p. 24. Reproduced with permission.

An Aquarium

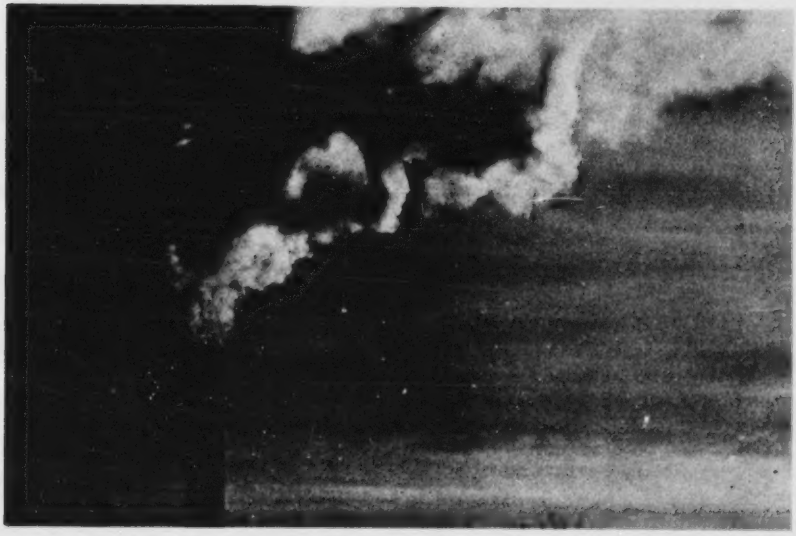
What animals live in the aquarium? Why do they need water? What do they eat? How often? How much? What happens to the food if they do not eat it? Why are there green plants? Look for the snails. What are they doing there? Why does the water not stay at the same level? How can you tell that the water level changed? Why do we need to add water from time to time? Why is the aquarium in the light or have a light over it? What might happen if it were kept in the dark?

Source: McIntyre, "Environmental Observations," pp. 24, 25. Reproduced with permission.

Air Pollution

Have any of you heard of air pollution? Where have you heard of this? What is polluted air? Is there any air pollution in this area right now? How can we find out? Taking a walk may be helpful. Can you see any dirt being spewed into the air? Look at cars and trucks. Do you see any dirt coming from their exhaust pipes? Where is the exhaust pipe? The children may need to see where these pipes are located on cars. A visit to the service station might locate some trucks so the children can see where exhausts are on the trucks. What happens to all the gases and smoke that are being put into the air? How does this affect the air we breathe? You could introduce five-year-olds to the concept of emission controls and what these are trying to do.

If the area is suburban and the weather cold, children could look at house chimneys. In areas close to commercial buildings and factories, smokestacks and chimneys could be looked at. Is there dirt coming from these? Is there an odor? Why are states and communities requiring factories to have filters and precipitators on smokestacks? What does a filter do? Have you ever seen any? Where? If smog is located in any of these areas, the idea of what smog is, how it is formed, and how dangerous it is to human beings, can be brought out.



Source: McIntyre, "Environmental Observations," p. 25. Reproduced with permission.

Level I Activity 7

Curriculum Sequence: Environmental Awareness
Goal: To develop an awareness of the components of the physical, biological and cultural environments and of how the pieces fit together.
Generalized Objective: The student will develop an awareness, an appreciation and a concern for his/her immediate environment.

Students, like most people, are not sensitive observers of the environment around them. Like most individuals, they do not examine their environment closely, but scan it and gain general impressions. To learn to be better observers, students need practice in close examination. Often this practice can be achieved through games. The following activity is an environment observation game, closely related to the roadside sign-alphabet game many children play in the car on family trips.

Alphabet Observation Hike

PURPOSE:

To help the individual become aware of native materials found in the outdoors through direct observations.

PROCEDURE:

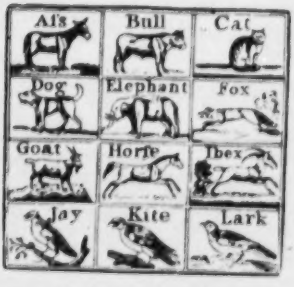
Divide into small groups and have each group list as many natural items as they can find beginning with each letter of the alphabet.

DIRECTIONS:

Find the objects listed below and then do the following things with each object:

1. look at the object
2. feel the object
3. smell the object
4. listen for sounds which may come from it or are associated with it
5. taste it (if safe to do so)

Write as many descriptive words as you can based on your sensory experiences.



Source: "A Few Elementary Environmental Education Ideas Collected from a Variety of Sources," Project ECO, Ames Community School District. Reproduced with permission from Project ECO.

Level I Activity 8

Curriculum Sequence: Environmental Awareness
Goal: To develop an awareness of the components of the physical, biological and cultural environments and of how the pieces fit together.
Generalized Objective: The student will develop an awareness, an appreciation and a concern for his/her immediate environment.

Another way to increase students' observation skills is to have them develop in miniature something that is usually much larger in nature. Working in miniature forces students to observe small details rather than large characteristics. In the following activity, students create miniature nature trails and learn to focus their attention on the smaller elements of the environment around them.

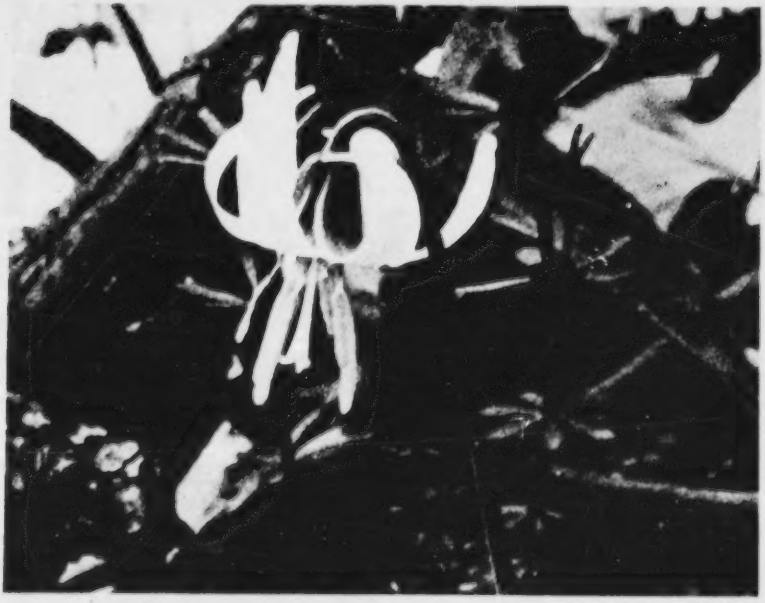
Micro Trail

MATERIALS:

Masking tape, toothpicks, felt pens, trail guide.

PROCEDURE:

1. Take students on a short walk through the woods (possibly park or school yard). By asking them questions about what they see, help them realize that we usually notice only the large things as we go through the woods (i.e., trees, squirrels, streams). As a group, zero in on some of the smaller things that can be seen (i.e., a seed, a single strand of moss, a tiny hole in the ground, etc.).



2. Divide the students into teams of two. Give each team a felt pen and enough toothpicks and masking tape for 10 mini-flags.
3. Tell the students that they have the next 15-20 minutes to construct a micro-nature trail. Have the students write a guide to go along with their trail. Written comments might give sensory descriptions rather than identification, or a combination of the two.
4. The aim of the micro trail is to point out as many interesting things as possible in as small an area as possible. Where a regular trail would cover a mile or more, the micro trails should only cover a matter of feet (or inches)!
5. Explain to the students that they are to number their stops or points of interest with the numbered flags and explain what they represent in the appropriately marked boxes on the trail guide.
6. The length of the trail should be about as long as one of the students lying down and stretched out.
7. After each team has finished its micro trail, have the teams trade written guides and tour the other teams' trails.

Source: Rachel Robertson, *Environmental Education Curriculum Guide - Grades K-6*, Clinton Conservation Board. Reproduced with permission of Rachel Robertson and the Clinton County Conservation Board.

Learning Activities for Level II

(Continuing Awareness and Management)

Level II Activity 1

Curriculum Sequence: Environmental Awareness
Goal: To develop an awareness of the components of the physical, biological and cultural environments and of how the pieces fit together.
Generalized Objective: The student will develop an awareness, an appreciation and a concern for his/her immediate environment.

Environmental awareness may be developed from many perspectives; i.e., science, economics, sociology, music, literature, poetry, or art. The awareness may involve not only the objects in nature, but their utility as well. The following activity develops environmental awareness through science, art and language arts. Students learn to observe elements of nature and then communicate their feelings through poetry and sketching. In addition, they learn to use natural elements (such as plant dyes) as tools in their work.

Observing and Interpreting Nature

DESCRIPTION:

This activity is multidisciplinary in nature depending on grade level and ability of your group. This lesson incorporates:

Science -- observing the object closely for details and becoming more aware.

Art --sketching and using natural dyes.

Language Arts -- writing a poem (cinquain or Haiku) about the object drawn.

MATERIALS NEEDED:

1. Sketching paper (typing or construction paper may be used, as long as it is white or creme in color) one per student.
2. An area rich in natural drawing supplies:
   rotten wood, mud, twigs -- brown
   ashes, charcoal -- gray or black
   dandelion flowers -- yellow
   violet, sweet william -- blue, purple
   leaves, grass, dandelion leaves -- green
   stems of leaves, flowers, berries -- red
   berries -- various colors
   flower petals -- various colors
   other goodies in season -- IMPROVISE!!
3. Pencils for Part B

Part A. Communicating Feelings of Awareness through Sketching

1. Distribute sketching paper (typing paper or construction paper will work). Have the student put his or her name on the back of the paper and then put the pencil or pen aside until later. Pencil or pen will not be used in the actual drawing of the object.
2. Instruct students to choose one object that belongs in nature--an insect, a bird, an animal, a fish, a leaf, a tree, a flower, etc.-- and

pretend that they have a camera and are going to take a close-up picture with this camera.

3. After they have decided which object they are going to focus on, ask them to think of where colors can be found in nature. For younger children you may need to get them started: soil - brown or black, leaves - green, etc.
4. Designate an area they may use to locate drawing materials. Allow about 20-30 minutes depending on the age of the students. Participants may draw with natural objects only.

Part B. Communicating Feelings of Awareness through Writing

1. If you are working with adults or high school age students, you may interrupt them during various stages of the sketching period to give them the instructions in section 2 below. However, students of middle school age and below should be allowed to complete the actual drawing and then do this step, perhaps after returning to a central location or to the classroom.

2. Give the following directions, allowing time between each for the students to write:

   a. Find a clear spot on the front of your sketch and write the name of the object you drew (cardinal, a flower, etc.).
   b. Under the object's name write two words that describe the object (you may need to explain to younger children what descriptive words are).
   c. Under the descriptive words, write three words that show the action your object makes in nature (bending, twisting, reaching, etc.).
   d. Next, write a short phrase (4-5 words) or short sentence that tells how the object fits in with the other things around it, how it fits in with the environment around it and what its value or usefulness is.
   e. Finally, write one word that sums up everything about the object you drew . . . how you feel about the object . . . (the word may summarize by comparison, analogy or synonym).

3. The above is the form used for writing a cinquain.
4. In place of the cinquain, Haiku may be written.
5. In Haiku there are three lines. In line one there are five syllables; line two has seven syllables; line three has five syllables.

Source: Susan Baldwin and Jo Rabe, *Color In The Environment*, Iowa Department of Public Instruction, 1974. Printed with permission of Susan Baldwin and Jo Rabe, Burlington Community School District.

Level II Activity 2

Curriculum Sequence: Environmental Awareness
Goal: To develop an awareness of the components of the physical, biological and cultural environments and of how the pieces fit together.
Generalized Objective: The student will learn about the various components that comprise the natural and man-made environments.

Children quickly learn the characteristics of their friends, how the friends are similar to the child or how they are different. They also learn special characteristics of friends so they are able to pick them out in a crowd. The following activity provides an opportunity for students to apply the same abilities in learning about a new friend in nature -- a tree. From this activity students will gain a greater knowledge about the various components that combine to form a tree and the environment of a tree.

Making Friends With a Tree

1. Explain to the class that they are about to make friends with a very important part of nature.
2. Give each student a paper bag blindfold. After placing the bags over their heads have them spin around several times to confuse their sense of direction. Guide each student to a tree. (You may have to take turns if there are not enough trees to go around.)
3. Ask the students to explore their new friend without making any noise. Suggested comments for direction:
   a. Reach as high as you can to discover how tall your friend is.
   b. Touch the bottom of your friend, feel around its base.
   c. Rub your cheek against the outer surface of your friend. Is it smooth or rough?
   d. Give your friend a big hug, reaching around it as far as possible.
   e. Try to guess how old your friend might be. Do you think your friend has had an easy life or a hard life? What hardships might your friend have encountered?
4. After students become acquainted with their trees through the sense of touch, lead them away again, have them spin around, and remove their blindfolds so they do not know where they have been.
5. Allow students to find their friend based on their acquaintance by touching.
6. Now observe your new friend by using all the senses.
   a. Listen to the wind as it blows through the leaves and branches.
   b. Smell the bark and a leaf from your friend.
   c. Feel again the texture of the bark, is it the same as when you were blindfolded?

7. Observe your friend once each month and add all new observations. Make a tree booklet to answer the following questions.
   a. Draw the shape of your friend.
   b. Select a leaf to be included in your tree booklet.
   c. Observe any damage to the tree and draw:
      holes
      small tunnels
      eaten leaves
      broken branches
      fungus plants (looks like shelves, pieces of white bread, hard moss on branches)
      aphids (tiny green insects on leaves)
      lichens (flat plants on trunk, green or gray)
   d. Are there any companions around? Look for:
      tracks
      nests
      homes in holes
      webs
      woodpecker holes
      caterpillars
      ants
      butterflies, moths
      other insects
      birds
      squirrels
   e. Draw a map of where your tree is located:
      size of tree
      height of tree
      diameter
      bark color
      texture of bark
   f. Examine a sample of soil from which your friend is growing:
      1. surface
      2. six inches below surface
      3. describe the soil and put a small sample in the booklet

Source: Robertson, *Environmental Education Curriculum Guide - Grades K-6.* Reproduced with permission.

Level II Activity 3

Curriculum Sequence: Environmental Awareness
Goal: To develop an awareness of the components of the physical, biological and cultural environments and of how the pieces fit together.
Generalized Objective: The student will learn about the various components that comprise the natural and man-made environments.

Collections of items from nature or recordings of sounds and shapes from nature (photographs, sound recordings, molds of animal tracks, drawings. etc.) can help students become more aware of the components of an environment, learn about those components and understand how they fit together. The following activity allows students to collect different forms of one of nature's most interesting products---spider webs.

Painting Spider Webs

EQUIPMENT:

Pieces of cardboard to put spider webs on, spray paint. sheets of glass, plastic or contact paper, scissors, adhesive tape.

ACTIVITIES:

Students will search for spider webs in various field locations. Find webs in locations where pieces of cardboard can be brought against them without running into twigs.

Observe the spider web before collecting it. Note the surrounding area. Speculate as to why the spider selected that location. What insects might be caught in the web? How does it work? How does the spider move around on the web? Which threads of the web are sticky? What are some habits of the spider?

Spray the web lightly but thoroughly with paint, on both sides if possible. Begin about two feet away from the web and spray from any angle.

While the paint is still "tacky," press the cardboard lightly against it. Cut off the supporting threads around the web. When the paint is dry, cover the web with a sheet of glass, plastic or contact paper. On the back of the cardboard, write the location of the web, date collected, name of collector. and if possible, the kind of spider.

Source: "A Few Elementary Environmental Education Ideas," Project ECO. Reproduced with permission.

Level II Activity 4

Curriculum Sequence: Environmental Awareness
Goal: To develop a working knowledge of the fundamentals of the sciences and their application to natural resource management and consumption.
Generalized Objective: The student will learn about the various components that comprise the natural and man-made environment.

Measuring, collecting and recording data, hypothesizing and testing hypotheses are all important fundamentals of the scientific method. The following activity provides students with an opportunity to practice these skills while learning more about snow. The activity is developed in the form of a worksheet for students. Individual teachers may desire to add to, or limit, the worksheet to meet their own needs.

Let It Snow, Let It Snow, Let It Snow

What is the temperature of the snow today?_____
What is the temperature of the air today?_____
Which is the warmest today?_____

Melt a can full of snow (not packed). How many centimeters of water did you get in your can?_____
Is the snow today a wet or dry snow?_____

Filter the water you just obtained when you melted your can of snow through a paper towel. Are there any dirt particles in your snow? _____

Weigh an empty can. Now fill the can with snow and weigh it again.
Subtract the weight of the empty can from the weight of the can when it is full of snow. What does the snow weigh?_____

Measure the depth of the snow in the following places:
Next to a log
In an open field
In the ditch along the road
In a patch of bushes
Where was the snow the deepest? Why do you think so?_____
_____
Where was the snow shallowest? Why do you think so?_____
_____

Mix a can of snow in a bucket half full of water. How cold does the water become (give temperature)?_____
Can you make the water even colder by adding more snow?_____
What is the lowest temperature you were able to reach?_____
How many cups of snow did it take?_____

Put a snowball on the end of a stick and bring it inside. How long do you think it will take before the first drop of water falls off the snowball?_____

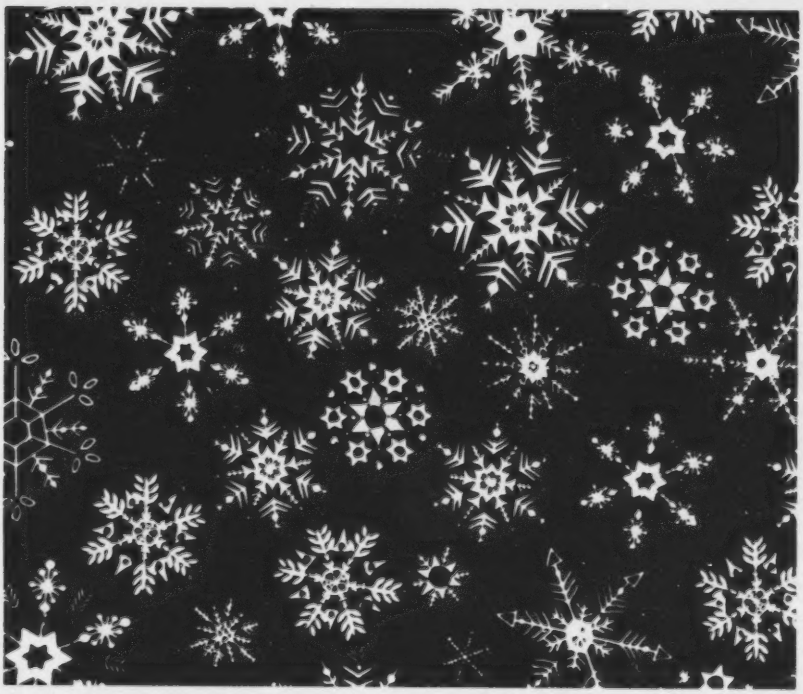
How many minutes did it actually take for the first drop of water to fall? _____

ANATOMY OF A SNOWBANK:

Students should choose two snowbanks that are different in size and shape. At each location a sketch should be made of the snowbank shape including length, width and heights at intervals of one meter along the snowbank. Notes should be made of any obstructions close by the snowbank. By comparing results with other groups, students should be able to determine wind direction at the time of deposition and that some form of obstruction was involved in each formation.

COMMENTS:

Students may wish to do a cross section study of a snowbank. Use of an area where snow has been deposited in consecutive storms will show distinct layers of deposition.



Source: *ECO Idea Packet* (Iowa State Education Association) and Project ECO. Reproduced with permission from Ken Frazier, Project ECO, Ames Community School District.

Level II Activity 5

Curriculum Sequence: Natural Resource Use and Environmental Management
Goal: To develop a working knowledge of the fundamentals of the sciences and their application to natural resource management and consumption.
Generalized Objective: The student will gain knowledge about the basic environmental concepts that affect life including the conservation of natural resources.

Simple experiments are often useful in providing students with experiences in collecting and recording data, and in developing hypotheses or conclusions from the data. Such experiments are also helpful in developing an understanding of concepts. The activity below helps students to understand the concept of "recycling" and it provides an opportunity for students to record data and draw conclusions from data.

Recycling In Soil

Almost all materials are eventually recycled. Earthworms, sow bugs, and other scavengers begin the recycling process by eating dead material. Decomposers then finish the jobs and break down materials for reuse by plants.

Man-made litter can often be recycled, but the process is slow. Materials that work best in this project are discarded leaf vegetables.

MATERIALS:

1. Give out charts (example below), and one of each type of bag to each group of students.
2. Tie bags firmly.
3. Dig a hole large enough for all three bags allowing for five centimeters (two inches) of space between bags.
4. Cover bags with soil and mark with a stake.
5. Allow two to ten weeks and dig up bags. Inspect the contents. Enter data in charts and compare.

Data Chart			
Container	Appearance of contents		
	before	after	change
Bag with large holes (mesh)			
Bag with small holes (nylon stockings)			
Plastic bag			

CONCLUSIONS:

How did the hole size of the bag change the recycling process? What would happen if dead plant materials were not recycled?

FOLLOW-UP:

Follow the same procedures, but submerge bags in a pond.

Source: *ECO Idea Packet*, Reproduced with permission.

Level II Activity 6

Curriculum Sequence: Natural Resource Use and Environmental Management
Goal: To develop a working knowledge of the fundamentals of the sciences and their application to natural resource management and consumption.
Generalized Objective: The student will gain knowledge about the basic environmental concepts that affect life including the conservation of natural resources.

Transforming natural resources into finished products or consumer goods is a process essential for our technological society's continuance and survival. Therefore, it is an important concept for students to understand. The following activity deals with the extraction of metals from ores and the importance of energy in the process.

Extraction of a Metal from Its Ore

OBJECTIVE:

To study the expendable minerals in our environment, and how we use energy to recover valuable metals from minerals.

LABORATORY MATERIALS:
Clay flowerpot (3 inch)
*Ferric oxide
Powered aluminum
Ring stand - ring
Sand - pan
Bunsen burner
Magnesium ribbon
Galena
Crucible with cover
Test tube - holder
Cinnabar
Iron pyrite - tongs

*(The thermite mixture and fuse might be purchased from a scientific supply house).

PROCEDURE:

Obtain a small (three-inch) clay flowerpot. Support it on a small ring stand. Place a pan of sand on the base of the ring stand just below the hole in the flowerpot. Mix about 11 grams of ferric oxide with 8.5 grams of powdered aluminum to form a thermite mixture. Pour the mixture into the flowerpot, and insert a fuse of magnesium ribbon about three inches long. Stand back and cautiously ignite the fuse with a Bunsen burner at arm's length. Stand back a few feet. The iron should fall into the pan of sand.

This is an example of metallurgy. Processes such as this, on a more elaborate scale, are used to obtain valuable metals from ores.

QUESTIONS TO THE STUDENT:

1. What was the source of energy necessary to cause this reaction?
2. Why are metals so important to our economy?
3. How many other metals, such as copper, aluminum, and lead, can be extracted from ores?
4. When would other sources of energy be necessary to obtain the metal?
5. What would these sources of energy be?
6. What will provide the energy?
7. How long will our source of metals last?
8. Does the rate of using metals fluctuate?

EXTENDING THE CONCEPT:

Discuss the extraction of aluminum from bauxite by electrical power. Heat galena (lead sulfide) in a closed crucible. Note the smell. Also hold a piece of iron pyrite (fool's gold) in a Bunsen burner flame. Note the odor.

Place a small amount of powdered cinnabar in a test tube. Heat gently in the Bunsen burner flame. Carefully note the odor. When some minerals are heated, can the by-product be used? When is it necessary to save the by-product? How can this chemical reaction pollute the air?

After discussing these questions, write the following statements on the blackboard. Select groups of two or three students to prove that the statements are false. Then ask the class: If these statements are false, what will make them true?

1. Man can always expect the supply of minerals to remain constant in the earth's crust.
2. There is only one method to obtain a metal or non-metal from its ore.
3. Useful by-products can never be recovered in a metallurgical process.
4. There is no need to provide an adequate water supply for electrical power for metallurgy.
5. As man uses the valuable ores, no effort will be made to recover the metals from the poorer grade ores.
6. There is no need to reserve coal and oil supplies for heat energy for metallurgy.
7. Man should make no attempt to conserve minerals.
8. Waste cannot be avoided in mining and metallurgical techniques.
9. Sulfur is an unlimited element in the earth's crust, and it has few important uses.
10. There are no state or federal laws which exist to encourage conservation in the mineral industries.

Source: Matthew Brennan, Ed., *People and Their Environment*, J. G. Ferguson Publishing, Chicago, Illinois, 1968. Reprinted with permission from J. G. Ferguson Publishing Co.

Activity 7 Level II

Curriculum Sequence: Natural Resource Use and Environmental Management
Goal: To develop a working knowledge of the fundamentals of the sciences and their application to natural resources management and consumption.
Generalized Objective: The student will gain knowledge about the basic environmental concepts that affect life including the conservation of natural resources.

Observing, experimenting and drawing conclusions are important skills in learning about the fundamentals of science. It is also important for students to learn how to develop a plan of action after applying these skills. The following activity (which is a series of activities) requires that students move from observing, experimenting and concluding, to developing a plan of action to remedy a problem situation in the environment.

Investigating a Soil Problem on the School Site

BEHAVIORAL OBJECTIVES:

At the completion of a successful encounter, the student should be able to:

1. Explain the origin of soil.
2. Identify the three areas of a soil profile.
3. Explain what is needed in soil for good plant growth.
4. Draw pictures that show how people are dependent, directly or indirectly, on soil.
5. Explain some ways that soil can be abused.
6. Identify a problem area of soil misuse around the school site.
7. Identify individuals who might help in resolving the problem.
8. Submit a plan to remedy the situation.

ACTIVITIES:

1. Tell where you think soil comes from.
2. Go out on the school site and collect or dig up some rocks.
   a. Separate the rocks into two piles: sedimentary (sandstone, limestone) and igneous rocks.
   b. Using the sandstone or limestone, rub two rocks together over a piece of newspaper (soil particles can be made by rubbing two rocks together).
   c. Using a hard (igneous) rock, place it in an old sock, and hit it with a hammer (chips are pieces of soil).
   d. In nature, soil particles from rocks are made by rain, water, wind, frost, lichens and plant roots.
3. Take a soil sample on the school site with an auger. (This may be obtained from a local soil conservation consultant.) If one is not available, use a shovel.
4. Identify the three areas of the soil profile: topsoil (A horizon), subsoil (B horizon), and parent material (C horizon).

a. Experiment with each to determine its fertility: Place a sample of each soil in three pots, and plant fast growing seeds. Which grow the best? Why? (Topsoil - has the most organic matter.)

b. Examine the three soils with a magnifying glass. What do you find in the topsoil that is not found in the other two? (Decayed plant and animal matter.)

5. Experiment with water penetration in sand and clay. Fill two jars with samples of each soil. Pour equal amounts of water in both jars. In which jar does the water pass through faster? (sand)

6. Examine the need for ground cover. Use two boxes, both with a screen on one end. Fill one box with soil and one with sod. Tilt both boxes upward, the lower end being the screened end. Have the screened ends resting in shallow pans. Pour equal amounts of water in each box. Which one loses the least water? (The box of sod - ground cover holds the water.)

7. Show slides depicting ways that soil can be destroyed.
   a. Erosion: wind, water.
   b. Exhaustion of nutrients.
   c. Burning.
   d. Overgrazing.
   e. Removal of surface plants.

8. Look for a soil problem area on the school site.
9. Identify the type of soil problem that it represents.
10. Take a soil profile of the problem area. Is there any A horizon (topsoil)? Does it contain any organic material? (Use a magnifying glass.) Is it heavily vegetated? Will watering help this problem or make it worse (cause more soil erosion)?
11. Use a soil testing kit. What minerals, if any, can be found in the topsoil? Why are these minerals important?
12. Make a chart listing all the information gathered about the problem area on the school site.
13. Invite the Soil Conservation Service personnel of your county to come and suggest remedies based on your information.
14. Prepare a plan using the information given by the Soil Conservation Service personnel and the suggestions of the students.
15. Present your plan to the principal, the student council, a student assembly, or to all three.
16. Enlist the help of the above individuals to remedy the soil problem on the school site.
17. Implement the plan.

Source: William B. Stapp and Dorothy A. Cox, *Environmental Education Activities Manual*, 1974. Reprinted with permission from William B. Stapp, University of Michigan.

Level II Activity 8

Curriculum Sequence: Environmental Decision-Making
Goal: To develop an awareness of the components of the physical, biological and cultural environment and of how the pieces fit together.
Generalized Objective: The student will gain knowledge about the basic environmental concepts that affect life including the conservation of natural resources.

A cemetery provides a convenient location for gaining an historical perspective and an awareness of change in man's ability to cope with the changing environment. The interactions of culture, technology and environment come alive. The following activity provides a series of questions that may be given to students to help them organize observations, collect data and formulate hypotheses on a cemetery field trip.

Exploring Old Cemeteries

1. Find the oldest tombstone.
   a. From what material was the oldest tombstone made?
   b. Where is the oldest tombstone located in the cemetery - Front? Back?
   c. How old was the individual who died?
   d. Is there a footstone? How far is the footstone from the headstone?
   e. What kind of vegetation is growing on or near the grave?
   f. Are there any trees growing adjacent to or on the grave? How old are the trees?
2. Find the youngest tombstone.
   a. From what material is the youngest tombstone made?
   b. Where is the youngest tombstone located in the cemetery - Front? Back?
   c. How old was the individual who died?
   d. Is there a footstone? How far is the headstone from the footstone?
   e. Are there any trees growing adjacent to or on the grave? How old are the trees?
3. When was the graveyard abandoned?
   a. How old is the biggest tree growing adjacent to a tombstone or on the grave?
   b. What is the date of the latest burial plot?
4. What is the condition of the soil?
   a. On the oldest grave?
   b. On the youngest grave?
5. Measure the depth of the inscriptions.
   a. on the oldest tombstone.
   b. on the youngest tombstone.

6. Is there evidence of a predominance of a single family?
7. What is the average age of death in ten-year intervals. For men? For women? For children?
8. Do the designs and shapes of the tombstones change through the years? If so, how?
9. Are there any graves that do not have tombstones? How can you tell it is a grave?
10. Can the tombstone and its general appearance relate what the standard of living was for the particular family or era?
11. Is there a fence or fencerow surrounding the graveyard? If so, what kind of fence or fencerow?
12. Is there evidence of a building? If so, what kind of building was it? For what purpose was it used?
13. Did the women live longer than the men? Was this true for one particular era?
14. Is there evidence of an epidemic? What kind of evidence?
15. Are there any unusual epitaphs on the tombstones? If so, why are they unusual?

Source: Thomas J. Rillo, "Exploring Old Cemeteries," *Science Activities*, May 1970. Reproduced with permission from Science Activities, Heldref Publications.

Learning Activities for Level III

(Advanced Concepts/Decision-Making)

Level III Activity 1

Curriculum Sequence: Natural Resource Use and Environmental Management.
Goal: To examine value systems regarding man's responsibility to his present and future environment.
Generalized Objective: The student will be able to think critically and make value judgements about man's impact on the environment and the societal and environmental changes resulting from natural resource use.

Observing, recording data, developing hypotheses and drawing conclusions are processes that may be applied in making value judgments. judgments of fact or scientific generalizations. Often collecting data and drawing conclusions based on these facts will cause students to examine their own values and actions. The following activity involves collecting data, hypothesizing and drawing conclusions about automobiles and the use of automobiles. The activity is not meant to impose values or behaviors on students, but it will encourage them to consider some of their own actions, the actions of their friends and those of their family.

Passenger/Car Ratio Study

ACTIVITIES:

1. Choose several locations for observing and recording the number of people in each passing car. (Examples: busy corner in a city, road leading to industrial plant, the entrance to a parking lot, etc.)
2. Record the following information on a chart:
   a. the number of cars by type, such as, compact and subcompact, standard, station wagon.
   b. the number of people in cars of each type.
3. Organize data in a form such as a chart or graph.
4. Study the data and discuss the following questions:
   a. At what time is the number of passengers per car greatest? Least?
   b. How do the different locations compare?
   c. Does the day of the week affect the number of passengers per car?
   d. Record any special events in your community that might affect the number of passengers per car?
   e. What explanation can you give for the variance in number of passengers at different times of the day?
   f. What excuses are used by individuals for not wanting to ride with others?
   g. What advantages can you give for more riders per car? Disadvantages?
   h. Do you notice any differences between teenagers and adults in car usage?
   i. In your opinion, has the number of passengers per car increased or decreased in the past few years?

j. What prediction would you make concerning the future number of passengers per car?

k. What methods would you suggest for greater use of car space?

l. If this study is carried out at a school where parking is a problem, how would you initiate a plan for improving the situation?

BACKGROUND INFORMATION FOR TEACHER:

Exhaust gas from cars is made up of several pollutants, including carbon monoxide, nitric oxide, nitrogen dioxide, and unburned hydrocarbons. Car manufacturers are required to produce cars with exhaust devices that keep the pollution level within limits. California was the first state to require special anti-pollution devices on auto exhausts. The 1970 federal standards call for an 80% reduction in hydrocarbons and 63.5% reduction in carbon monoxide compared with the 1964 levels. The automobile is one of the sources of serious air pollution. We realize that an anti-pollution device on cars is only one solution to the problem. Nevertheless, the more efficient use of cars, such as increasing the number of passengers carried, could help cut pollution.

Source: "A Few Elementary Environmental Education Ideas," Project ECO. Reproduced with permission.

Level III Activity 2

Curriculum Sequence: Natural Resource Use and Environmental Management
Goal: To examine value systems regarding man's responsibility to his present and future environment.
Generalized Objective: The student will be able to think critically and make value judgments about man's impact on the environment and the societal and environmental changes resulting from natural resource use.

Activities conducted without organization, without a system for recording data and without a purpose beyond the activity itself are not very educational. The following activity provides a process for changing a litter clean-up campaign into a significant scientific survey with a public impact purpose. Individual teachers who are interested in adding another feature to the activity might have students separate their collection by time required for decomposition; i.e., not only show how much litter was collected but how long that litter could be expected to remain in the environment. A chart useful for calculating time required for decomposition can be found in the May 1978 issue of *Outside* magazine.

This activity has the potential for affecting not only the values and behavior of students, but those of the community as well.

Litter Survey

This activity gives a litter pick-up campaign a scientific flavor. Instead of just collecting litter in a park, record the amount and type of litter found. This can be an annual project in which year-to-year comparisons are made, or it can be done in a shorter period of time (one month) to show the rate of littering.

Publicity of this activity by local newspaper, radio and T.V. makes for even more interest on the part of the students and informs the public of what your class is doing to combat the "throw away syndrome."

Summary Table for Class								
	Non-Returnable				Returnable			
Item	glass	metal	paper	plastic	glass	metal	paper	plastic
Beer								
Soda								
Liquor								
Milk								
Other								

SUGGESTED ACTIVITIES:

Calculate the amount of litter per square meter: calculate what percentage of the litter collected is cans, bottles, etc. After the survey has been conducted several times over the same area, calculate the rate of littering. Homework: conduct an opinion poll on the project to see if community interest has been aroused.

Source: *ECO Idea Packet*. Reproduced with permission.

Level III Activity 3

Curriculum Sequence: Natural Resource Use and Environmental Management.
Goal: To develop a working knowledge of the fundamentals of the sciences and their application to natural resource management and consumption.
Generalized Objective: The student will be able to think critically and make value judgments about man's impact on the environment and the societal and environmental changes resulting from natural resource use.

Hypotheses are often developed to explain a set of data gathered through observation. In the following activity, students develop hypotheses using data collected from around a building during a short observation period. The hypotheses will reflect both the influence of natural factors and man-made factors on an environment. Individual teachers may want to follow up on this activity by helping students devise systems to test some of the hypotheses that are developed.

Plants Around a Building

CHALLENGE: Discover How the Conditions Around a Building Affect the Growth of Plants.

PREPARATION:

1. Select a building site for the activity. Any kind of building is fine, but one in an open area is preferred. Results will be quite different depending on whether or not the perimeter of the building is gardened.

2. Prepare and have available an outline map of the building and the land around it for each team of three or four participants. Also prepare one large outline map. The map needs to show only the outline of the building and any other significant nearby structures.
3. Reproduce enough "Action Cards" for each team to have one card. Include some of your own instructions and questions about features unique to the particular building you have chosen.

ACTION CARDS:

1. Find and mark on your map those places where plants seem to grow much larger than the same kind of plants in other places around the building. What do you think is causing this in each case?
2. Find and mark on your map those places where plants seem to grow much smaller than the same kind of plants in other places around the building. What do you think is causing this in each case?
3. Find and mark on your map those places where the number of plants in a small area is high. What do you think is causing this in each case?
4. Find and mark on your map those places where the number of plants in a small area is very low. What do you think is causing this in each case?
5. Find and mark on your map those places where no plants grow. What do you think is causing this in each case?
6. Find and mark on your map the least common plant growing around the building. Are there any special conditions which permit it to grow in that place or places?

ACTIVITY:

1. Divide the group into teams of two or four students.
2. Distribute outline maps and help the group figure out orientation of the map to the building.
3. Distribute "Action Cards" and tell the teams to find as many examples as they can of the situation described on the team card. They should mark each place selected on the outline map.
4. After 15 or 20 minutes, gather the group together, have them transfer their records to the large outline map and discuss what might have caused the observed results. Introduce the idea that environmental factors, such as moisture, light, temperature, or trampling might be responsible.

Source: *Outdoor Biology Instructional Strategies* (OBIS), Trial Edition Set 1, 1975. Reproduced with permission from OBIS, Lawrence Hall of Science, University of California, Berkeley, CA 94720.

Level III Activity 4

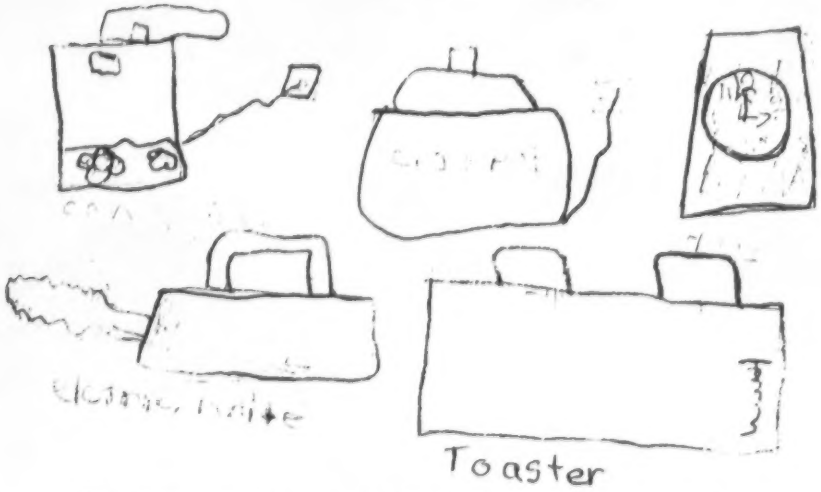
Curriculum Sequence: Environmental Decision-Making
Goal: To develop an understanding of the political and economic interactions involved in deciding between alternatives.
Generalized Objective: The student will be able to think critically and make value judgments about man's impact on the environment and the societal and environmental changes resulting from natural resource use.

Students must learn to make decisions and justify those decisions in a rational manner. In the following activity, students are asked to make decisions about electrical appliances. Teachers may desire to precede this activity with a discussion of where electrical energy comes from and why it is important to conserve electrical energy. After completing the activity, students should discuss the reasons for their decisions.

Uses of Energy - Appliances

ACTIVITIES:

1. The students will state at least three advantages and disadvantages of using each of the following electrical appliances: toothbrush, toaster, hot water heater, freezer, lights, air conditioning, radio, television, stove, dishwasher, microwave oven, clothes washer, clothes dryer.
2. The students will list or draw the electrical appliances in their homes in the order of their importance.
3. The students will list or draw five different electrical applicances used in their homes that the family could most easily live without. What effect would this have on the family?



Source: *Elementary Environmental Education Activities - Grades 3-6.* Reproduced with permission from Marshalltown Community School District.

Level III Activity 5

Curriculum Sequence: Environmental Decision-Making
Goal: To develop an understanding of the political and economic interactions involved in deciding between alternatives.
Generalized Objective: The student will understand the public policy decision-making process and be able to make inputs into current environmental decisions.

The following simulation game is to be played by 15 to 25 persons and eight leaders. During the game they will learn to present positions, listen to alternatives, make decisions and compromise. Practicing these skills is important if students are to be prepared to make decisions on environmental issues that will confront them during their adult life. The following activity focuses on one type of environmental decision-making---land zoning.

The Big Bean Company

The Situation:

The city planning department of Sunspot, Iowa, has just completed a long-range plan for the city, including the necessary capital investment priorities. The plan was adopted after prolonged public hearings and had the approval of a majority of Sunspot's citizens, including environmental and business leaders.

Now the Big Bean Company, an agricultural implement company, proposes to build an industrial-commercial-residential complex for 2,000 people in an area which the city plan had designated for park, wilderness and scenic lands. The industry has asked the Planning and Zoning Commission of Sunspot to grant a variance which would allow construction of the complex. Participants form teams and through role-playing try to influence the Planning and Zoning Commission's decision.

The Facts:

Sunspot has an area of 18 sq. miles and a population of 15,900, 7% unemployment.

The land proposed for Big Bean's project is now owned by private individuals. It was used for agriculture in the past, even though it is within the city limits. Some woods are included.

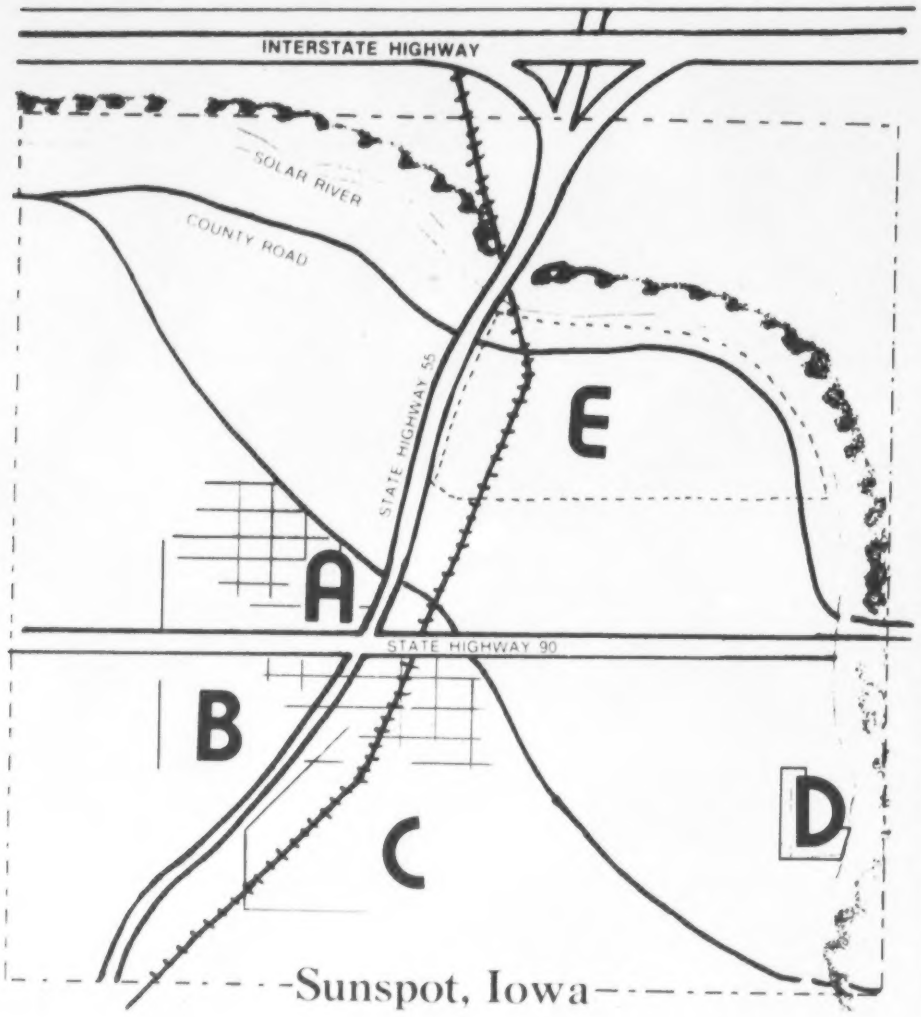
The whole tract will be almost one sq. mile, or 640 acres. The plant will cover 1/2 million square feet, approximately 12 acres, with five acres for parking. The area being considered is not susceptible to flooding.

The industry proposes to build a self-sufficient complex with its own recreation area, shopping center and sewage system which will connect with the town's facilities.

The planned housing complex will include town houses, single family dwellings, garden apartments and condominiums. The industry would initiate planning and coordinate construction, but contracts would be let to out-of-town developers.

Price of housing ranges from $42,000 to $90,000. Rentals are available in town houses and garden apartments. The planned housing complex is expected to attract 2,000 employees and their families.

The industry plans to build a model plant and community, attractively landscaped and designed to meet all environmental guidelines. It will donate land for a school.



A. Present business district
B. City Park
C. Industrial Park
D. Sewage treatment plant
E. Big Bean's proposed addition
- - - - - - - - Present city limits.

The Players:

INDUSTRY (THE BIG BEAN COMPANY)
(3 to 5 players)

Objective: To get land rezoned from park and recreation use to manufacturing, commercial and multi-family dwellings.
Preparation: Assume that you have already made a written application to the Planning & Zoning Commission. Go over your proposed plan and think of arguments you will use to persuade the Commission to grant your request.
Interaction:
1. Meet Citizens For the Complex
2. Interview with News Reporter
3. Meet with Environmental Group

Hearing: Present arguments to Planning and Zoning Commission.

ENVIRONMENTAL GROUP
(3 to 5 players)

Objective: Prevent zoning change. Keep land for park and wilderness.
Preparation: Work on arguments supporting your objective.
Interaction:
1. Meet News Reporter
2. Meet Neutral Citizens
3. Meet Industry Representatives

Hearing: Present arguments to Planning and Zoning Commission.

CITIZENS FOR THE COMPLEX
(3 to 5 players)

Objective: Support industry in getting zoning variance.
Preparation: Prepare arguments supporting your objective.
Interaction:
1. Meet with Industry
2. One representative meet with News Reporter; the rest meet with Citizens Against the Project
3. Meet with Neutral Citizens

Hearing: Coordinate with Industry in preparing arguments.

CITIZENS AGAINST THE PROJECT
(3 to 5 players)

Objective: Prevent zoning change; either keep industry out entirely or confine it to the industrial park area.
Preparation: Prepare arguments to support your objective.
Interaction:
1. Meet Neutral Citizens
2. Meet Citizens For the Complex

3. Meet News Reporter

Hearing: Present your arguments to the Planning and Zoning Commission.

NEUTRAL CITIZENS
(4 to 6 players)

Objective: Listen to all sides and try to form an opinion: attend the public hearing.

Preparation: Give initial impressions to News Reporter.

Interaction:

1. Meet Citizens Against the Project
2. Meet Environmental Group
3. Meet Citizens For the Complex

Hearing: Ask questions after each team's presentation. You may give a two-minute speech if you wish.

PLANNING & ZONING COMMISSION
(3 players)

Objective: Decide if land should be rezoned and make recommendation to city council.

Preparation: Notify all groups of time and place of the public hearing. Familiarize yourselves with corporation plans. Review map and zoning laws.

Interaction: Move at random among groups, but do not participate in discussions.

Hearing: Listen to all groups and then vote on the proposal.

REPORTER FOR THE SUNSPOT TIMES
(one or more players)

Objective: Interview all groups and keep public informed of developments via oral news bulletins.

Preparation: Interview Neutral Citizens for their initial reactions to Big Bean Complex.

Interaction:

1. Interview Environmental Group
2. Interview Industry and Citizens For the Complex
3. Interview Citizens Against the Project

Issue oral bulletins after each of the above interviews.

Hearing: Listen to all sides and aid in evaluation.

To play the game you need:

A timekeeper and clock
A bell to signal time periods
Name tags color-coded for easy identification of teams
Signs to designate team headquarters.

Time Schedule:

Introduction	5 minutes	Moderator explains game
Preparation	10 minutes	Teams prepare arguments; News Reporter interviews Neutral Citizens.
Interaction	20 minutes	Teams interact with each other. (See interaction schedule.)
Final Prep.	5 minutes	Each team selects one person to present its arguments to the Planning and Zoning (P & Z) Commission.
P & Z Hearing	20 minutes	Representative from each team gives arguments. Neutral citizens ask questions and speak. (See hearing schedule.)
Evaluation	10 minutes	After the P & Z Commission gives a decision, participants drop roles and judge game's success.

Hearing Schedule:

1. Industry (Big Bean Co.)
2. Environmental Group (Envir. Gr.)
3. Citizens For the Complex (C.F.C.)
4. Citizens Against the Project (C.A.P.)
5. Neutral Citizens

Each team has a three-minute limit. Neutral Citizens may ask questions after each presentation, with a limit of two-minutes each, and they may each speak for two-minutes. Following the presentation, the Commission retires to make a decision on rezoning this piece of property.

Interaction Schedule:

Three periods of seven minutes followed by a bulletin from the News Reporter

Industry
1. C.F.C.
2. Reporter
3. Envir. Gr.

C. F. C.
1. Industry
2. C.A.P. (one reporter)
3. Neutrals

Envir. Gr.
1. Reporter
2. Reporter
3. Industry

C.A.P.
1. Neutrals
2. C.F.C.
3. Reporter

Neutrals
1. C.A.P.
2. Envir. Gr.
3. C.F.C.

Reporter
1. Envir. Gr.
2. Industry and C.F.C.
3. C.A.P.

Source: A simulation game adapted from "Urbanity," a pamphlet published by the League of Women Voters of Iowa.

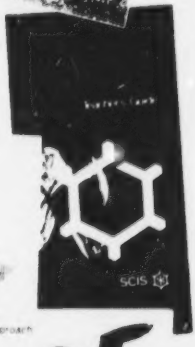
Governor's Environmental/Conservation
Education Conference · April 25-26, 1977

PROJECT LEARNING TREE
Supplementary Activity Guide
For Grades K through 6

ENERGY
Conservation Activity Packet

ENERGY
Conservation Activity Packet

Project SCATE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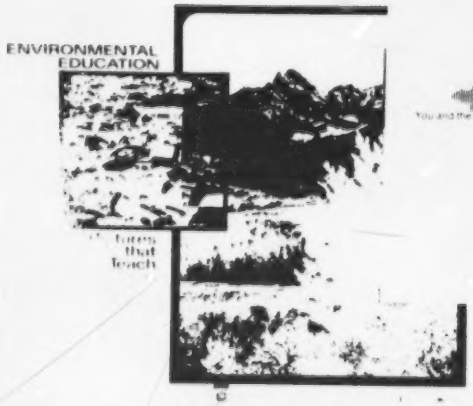
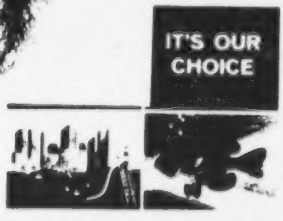

ENVIRONMENTAL EDUCATION
Items that Teach

You and the Environment
An Investigative Approach


IT'S OUR CHOICE

7 Teaching Resources and References

While the basic principles of the environmental education process are well established, rapid change occurs in their application to local situations. The mass media are continually reporting new environmental information along with new solutions and new problems. The agencies and organizations listed in this chapter are sources of information that are easily available to the public.

Assistance on curriculum planning and environmental education programming can be obtained from area education agencies and from the environmental education consultant of the Department of Public Instruction. Universities and colleges in Iowa have individuals with expertise who are available to consult on planning and programming for environmental education and for inservice staff development. A majority of Iowa's counties have a county environmental education or conservation education committee composed of teachers and other interested persons. The identity of the committee chairman can be obtained from the County Soil Conservation District office.

Key

P - Publications including pamphlets, reports, books, periodicals
R - Resource people who may be called upon to speak to classes and groups
A - Audio-visual materials including slides and films

Local Offices:

P,A Area Education Media Centers
P,R,A Conservation Officer of the State Conservation Commission
P,R,A Cooperative Extension Service
P,R County Conservation Board
P,R,A County Soil Conservation District and the U.S. Soil Conservation Service (in same office)

Local Organizations:

Audubon Societies
County Conservation or Environmental Education Committees
Garden Clubs
Izaak Walton League chapters
League of Women Voters
Wildlife Federation affiliated sportsmen's clubs
Women's Clubs

State and Regional Offices:

P Environmental Protection Agency
1735 Baltimore Avenue
Kansas City, Missouri 64108

P Iowa Department of Environmental Quality
Wallace Bldg.
Des Moines, Iowa 50319

P Iowa Department of Public Instruction
Curriculum Division
Grimes State Office Building
Des Moines, Iowa 50319

P Iowa Energy Policy Council
215 E. 7th Street
Des Moines, Iowa 50319

P Iowa Geological Survey
123 Capitol Street
Iowa City, Iowa 52240

P,R,A State Conservation Commission
Conservation Education Center
Box 138C
Guthrie Center, Iowa 50115

P,A U.S. Forest Service
Information and Education Division
633 West Wisconsin Avenue
Milwaukee, Wisconsin 53203

As a group, teachers tend to be borrowers rather than users. That is, given the opportunity, we like to adapt new ideas, new methods or new materials to our own ways rather than adopt it as it comes from the box. It is not that we are inflexible. We have merely found our own personal style and see the flexibility that exists in those "things" which we use when teaching. One professional teacher states it this way: "Teachers don't have to be creative - just resourceful."

This chapter contains the grist for the mill of teacher resourcefulness. No attempt has been made to produce an exhaustive list of references for the teacher. This field is growing at an incredible rate and any list is well dated by the time it is published.

To keep abreast of the latest materials, participate in inservice workshops sponsored by Iowa Conservation Education Council, area education agencies, Iowa colleges and universities, and the Iowa Department of Public Instruction (D.P.I.). Also, contact D.P.I. to have your name and your schools' name placed on its mailing list for materials coming from the environmental education consultant's office.

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